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WHITE-TAILED DEER OF THE ADIRONDACKS

CONTENTS OF RECENT ROOSEVELT WILD LIFE BULLETINS AND ANNALS

BULLETINS

ROOSEVELT WILD LIFE BULLETIN, Vol. 3, No. 1. February, 1925.

1. The Birds of the Yellowstone National Park.....Milton P. Skinner.
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ROOSEVELT WILD LIFE BULLETIN, Vol. 3, No. 2. March, 1925.

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Charles E. Johnson.
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2. Additional Notes on the Summer Birds of Allegany State Park.....
Aretas A. Saunders.
3. Current Station Notes.....Charles C. Adams.

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1. The Economic and Social Importance of Animals in Forestry.....
Charles C. Adams.
2. The Land—Economic Survey in Michigan.....R. A. Smith.
3. Current Station Notes.....Charles C. Adams.

ROOSEVELT WILD LIFE BULLETIN, Vol. 4, No. 1. October, 1926.

1. The Relation of Birds to Woodlots in New York State.....
W. L. McAtee.
2. Current Station Notes.....Charles C. Adams.

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ParkMilton P. Skinner.
2. Current Station Notes.....Charles C. Adams.

ROOSEVELT WILD LIFE BULLETIN, Vol. 4, No. 3. July, 1927.

1. A Trout Survey of the Allegany State Park in 1922.....
William C. Kendall and Wilford A. Dence.
2. A Preliminary Survey of the Fish Life of Allegany State Park, 1921
Thomas L. Hankinson.
3. Current Station Notes.....Charles C. Adams.

ROOSEVELT WILD LIFE BULLETIN, Vol. 4, No. 4. July, 1927.

1. The Beaver in the Adirondacks: Its Economics and Natural History..
Charles E. Johnson.

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GENERAL CONTENTS

	PAGE
I. The White-tailed Deer of the Adirondacks.....	161
Part 1. Preliminary Survey of the White-tailed Deer of the Adirondacks	
M. T. Townsend and M. W. Smith..	162
Part 2. Ecology of the White-tailed Deer in Summer with Special Reference to the Adirondacks	
M. T. Townsend and M. W. Smith..	247
II. Some Late Winter and Early Spring Observations on the White-tailed Deer of the Adirondacks....	Chas. J. Spiker 327

ILLUSTRATIONS

PLATES

Plate 4. White-tailed Doe with Twin Fawns (Drawing by Edmund J. Sawyer).....	<i>Facing</i> 161
Plate 5. White-tailed Buck (Drawing by Edmund J. Sawyer).	246

FIGURES

(All photographs by the authors unless otherwise indicated)

Fig. 75. A general view of T-Lake and surrounding country, taken from the top of T-Lake Mountain.....	163
Fig. 76. Blackfoot Pond. A great many deer tracks were found on the grassy flat. June 9, 1927.....	163
Fig. 77. Along Beaver River Flow near Brandreth. This gives an idea of the type of shore line formed as the water recedes in summer. The doe shown in the view was at the time feeding on raspberry leaves. July 26, 1927.....	164
Fig. 78. The set-back along the outlet of Falls Lake, Brandreth. In the spring this is entirely overflowed, but as the summer progresses the lowering water leaves a mud flat with innumera- ble pools in which the algae grow profusely. August 15, 1927.	164
Fig. 79. Nehasane Lake. This is an example of a typical lake frequented by deer. Notice the low-lying shore lines and beds of pond lilies in the shallow water. August 20, 1927.....	171
Fig. 80. T-Lake from the south shore.....	171
Fig. 81. The west end of White Birch Lake, showing submerged bushes where deer waded.....	172
Fig. 82. Scotch Lake, Piseco.....	172
Fig. 83. A submerged alder swamp at the south end of Scotch Lake, the result of a beaver dam.....	177
Fig. 84. Cold Stream Lake. Many deer here fed on the algae growing in the shallow water. August 10, 1928.....	177
Fig. 85. "L.D." Lake as seen from the south. A beaver dam on the out- let has backed the water up into the low woods in the fore- ground, thus producing good summer feeding grounds for deer.	178
Fig. 86. The north shore of "L.D." Lake in summer. The wide mud flat was a favorite feeding ground for deer.....	178
Fig. 87. Small beaver pond on outlet from "L.D." Lake. Tracks of deer were numerous in the mud.....	185
Fig. 88. Vly Lake. There is quite an extensive vly on the west shore shown in the view. July 30, 1928.....	185

Fig. 89.	Fall Stream between Fall Lake and Vly Lake. The shores here at many points are open, providing stretches of ground covered with a rank growth of grass. May 31, 1928.....	186
Fig. 90.	The lower reaches of Fall Stream, showing swampy, thicket covered shores. Most of the shore was a quaking bog.....	186
Fig. 91.	Section of low woods at east end of Little T-Lake, flooded by beavers. Deer were frequently seen wading among the dead trees and feeding below the water on deer grass, algae, etc....	193
Fig. 92.	Grassy marsh on outlet from T-Lake. The result of beaver dams	193
Fig. 93.	The submerged woods at west end of White Birch Lake. The dead trees are the result of a beaver dam on the outlet of the lake. A favorite feeding ground for deer.....	194
Fig. 94.	Lizard Lake, showing grassy shores typical of a lake undisturbed by beavers. A seven-point buck is standing in the grass of the opposite shore near the center of the picture.....	194
Fig. 95.	Milligan Vly, Piseco, showing mud shores and dead trees and alders as a result of flooding by beaver damming.....	197
Fig. 96.	Dead Man's Vly. A ten-point buck was observed to lie down in the open vly near the tree in the center, in early afternoon....	197
Fig. 97.	From Buck Mountain tower. Left to right: Little Tupper Lake, "The Slang", Round Pond (background), Bog Stream or Sperry Brook (right middle distance). July 15, 1929.....	198
Fig. 98.	Looking east from Buck Mountain tower. Moonshine Pond to the left center. July 15, 1929.....	198
Fig. 99.	Upper Bog Stream, showing grass meadows and clumps of alders. August 29, 1929.....	203
Fig. 100.	Alder thicket along Bog Stream. August 29, 1929.....	203
Fig. 101.	Hay meadows near Upper Bog Stream. August 29, 1929.....	204
Fig. 102.	Bog Stream. Deer waded into the water from the grassy shores, such as the one at the left, rather than from the dense alder thickets at the right. August 29, 1929.....	204
Fig. 103.	Grassy shore along Bog Stream showing runways leading into water. August 29, 1929.....	209
Fig. 104.	Northern shore of Stony Pond. Deer wading at edge of water, left center. July 15, 1929.....	209
Fig. 105.	Slim Pond. Steep rocky shores, a relatively poor feeding ground for deer. July 30, 1929.....	210
Fig. 106.	West Shore of Robinson Pond. A favorite feeding ground for deer in July. August 20, 1929.....	210
Fig. 107.	South shore of Little Flatfish Pond. August 19, 1929.....	215
Fig. 108.	North shore of Little Flatfish Pond. August 19, 1929.....	215
Fig. 109.	Doe at water's edge. Big Flatfish Pond.....	216
Fig. 110.	South end of Antedeluvian Pond with low shore.....	216
Fig. 111.	Sweet gale flats along "The Slang". Deer waded and swam to the lily pads in July. They also fed on the low vegetation beneath the bushes shown in foreground. July 20, 1929.....	223
Fig. 112.	A close view of a rubbing tree, showing the bark torn off in shreds which hang downward, indicating perhaps that the animal rubbed with a downward movement.....	223
Fig. 113.	A tame deer owned by H. Rogers of Lake Pleasant, showing growth of antlers before the animal was castrated. Photograph by H. Rogers.....	224
Fig. 114.	Another view of the same deer in a different year. Photograph by H. Rogers.....	224
Fig. 115.	The tame deer a few seasons after the castration, showing the freak stub antlers which developed after the operation.....	227
Fig. 116.	Another view of the castrated tame deer to show the freak stub antlers	227

Fig. 117.	A beaver pond on Indian Brook, near Old Forge. This and other such ponds were favorite foraging places for deer. The land adjoining is an old burn. June 17, 1927.....	227
Fig. 118.	A close-up view along the shore line of Beaver River Flow proper. The doe is feeding on raspberry. The fawn is one of twins. August 3, 1927.....	223
Fig. 119.	A view taken a minute after that of figure 118. The doe moved away at the click of the camera, but the curious fawn remained and even came closer after its picture was taken. August 3, 1927	228
Fig. 120.	Set-back along the outlet of Falls Lake, Brandreth. A doe may be seen a little to the right of center, feeding on algae in a stagnant pool. August 15, 1927.....	233
Fig. 121.	The outlet of Falls Lake at the point where it joins the Beaver River Flow. Mats of algae can be seen on the surface of the water in the left foreground and also clinging to the dead brush. These plants were eaten in quantity along the Flow. August 6, 1927.....	233
Fig. 122.	A bed of yellow pond lilies in the inlet to Stafford Pond, near Big Moose. Such beds were favorite feeding places for deer, especially in July. July 9, 1927.....	234
Fig. 123.	Raspberry patch near Falls Lake, Piseco, trampled down and eaten by deer in August.....	234
Fig. 124.	Showing droppings of nettle along the Spruce Lake trail. As can be seen the greater number of the shoots have been stripped of their leaves by deer. August 11, 1928.....	239
Fig. 125.	A grubbing place. Below the hat and in front of the small hemlock may be seen a patch that has been torn up. July 23, 1928.	239
Fig. 126.	A root-grubbing place. About eight feet from a small spruce tree	240
Fig. 127.	Grubbing spots abundant in tall grass near edge of bushes where tripod and case are seen. Sperry Bog Stream. July 16, 1929.	240
Fig. 128.	Knife points to a grubbing spot in tall grass. Sperry Bog Stream. July 16, 1929.....	251
Fig. 129.	Grubbing spots in tall grass (centering around hat). Sperry Bog Stream. July 16, 1929.....	251
Fig. 130.	An old stump near T-Lake which had been chewed by the deer. Close to the knife may be seen a few dung pellets.....	252
Fig. 131.	Examples of an old log torn by bear. Claw marks of the animal were found just below the ruler and tracks were seen in the soft earth	252
Fig. 132.	Showing an old rotten log chewed by deer. The fine shredding of the wood fibers is typical of the work of deer.....	257
Fig. 133.	A small salt lick near T-Lake Mountain fire station. The old stump had been thoroughly chewed by the deer. The fallen log showed signs of porcupine gnawing when the picture was taken, and no deer had been seen here for several days.....	257
Fig. 134.	Salt lick near Keepawa. Salt had been placed on the stump which had been thoroughly chewed by the deer. The ground around was packed hard by constant tramping.....	258
Fig. 135.	The forest floor showing scattered pellets of deer excrement in the left center of picture.....	258
Fig. 136.	Deer droppings. Just to the right of the compass is a typical cluster	261
Fig. 137.	Showing a patch of porcupine dung pellets, easily confused with deer pellets	261
Fig. 138.	Along Fall Stream above Vly Lake. The sand spit shown is representative of others on which the deer seemingly liked to wander, probably from a desire to get in the open. July 9, 1928	262

- Fig. 139. A freak three-legged buck shot near Piseco in 1923. No sign of left foreleg was seen, according to accounts. The animal was very poor and lousy..... 262
- Fig. 140. Doe struck by an automobile on the highway. Both hind legs were broken so the animal was shot. July 10, 1929..... 267
- Fig. 141. Yearling doe in an old clearing on the Nehasane preserve. It was foraging on the white clover that grew there in abundance. Photograph by B. A. Scudder..... 267
- Fig. 142. A bed spot in the woods near Hedgehog Pond. The deer had been lying near the center of the photograph. August 9, 1929. 268
- Fig. 143. A bed spot amid raspberry bushes. A three-point buck was found lying down at spot just in front of the pack..... 263
- Fig. 144. The bed ground of a fawn. The animal was lying just in front of the rotten log where the hunting knife is placed..... 273
- Fig. 145. Tall meadow grass at eastern end of Dead Man's Vly. A ten-point buck was startled from his bed here at mid-day..... 273
- Fig. 146. The bed occupied by the ten-point buck at Dead Man's Vly. The matted grass in the middle foreground indicates the spot where the animal lay 274
- Fig. 147. A bed spot at Dead Man's Vly. The bed had been occupied by an unusually large deer. Below the compass may be seen a heap of droppings..... 274
- Fig. 148. View of a grassy glade north of Vly Lake where several bed spots were found in the tall grass..... 279
- Fig. 149. Meadow at Ten-Mile Mark. A favorite feeding ground in summer. August 29, 1929..... 279
- Fig. 150. A runway on a ridge top near Piseco. The tracks led across the end of the log and past the small axe in the middle distance. 280
- Fig. 151. Another view of the runway across the top of a ridge near Piseco. The hat is lying in the path..... 280
- Fig. 152. Woods on the west shore of T-Lake. A runway passes close to the hemlock tree in the middle distance..... 285
- Fig. 153. A runway through the ferns near Antedeluvian Pond outlet. August 30, 1929..... 285
- Fig. 154. Grassy swamp near Otter Pond stream. A runway leads into the distance, just to the right of the hat. August 12, 1929.... 286
- Fig. 155. Region of "The Slang". A runway through the laurels along the side of a knoll in the swamp. Runway is quite distinct to left of hat. July 20, 1929..... 286
- Fig. 156. A runway among the laurels and alders at the outlet from T-Lake. The tracks pass between the hat and the small tree at the left..... 291
- Fig. 157. North shore of Stony Pond; a sandy bottomed shore, used as a runway by deer that waded along and fed on shore bushes. July 15, 1929..... 291
- Fig. 158. A sand spit near Vly Lake. In the left foreground may be seen tracks of a raccoon. Beyond the hat are tracks of two deer leading into the middle distance..... 292
- Fig. 159. Another view of the sand spit near Vly Lake, showing numerous deer tracks 292
- Fig. 160. Outlet from T-Lake. The muddy flats are here overgrown with dense stands of laurel, alders, etc. Deer tracks were numerous along the opposite shore..... 297
- Fig. 161. Another view of the mud flat and low woods along west shore of T-Lake 297
- Fig. 162. West shore of T-Lake, as seen from the observation blind on the east shore. A favorite feeding ground for deer in early summer was the section of swampy shore at the left center of the picture 298
- Fig. 163. Submerged bushes along the west shore of T-Lake. A favorite feeding spot for deer during late June and July..... 298

Fig. 164.	"The Slang" and an evergreen-covered knoll. July 20, 1929....	303
Fig. 165.	A typical evergreen-covered knoll in the swamp along "The Slang". Deer had runways around this knoll and the alder swamp in the background. July 20, 1929.....	303
Fig. 166.	Just in front of the buildings in the middle distance may be seen a tame deer in the act of lying down. The animal goes down on its "knees" first, then the hind quarters follow.....	304
Fig. 167.	Blind fawn found in woods on Buck Mountain. Note characteristic pose. August 10, 1929.....	304
Fig. 168.	Pasture north of Piseco village where deer were commonly seen at dawn and dusk during June. June 11, 1928.....	311
Fig. 169.	A pasture edge where a buck fed regularly for several mornings in June, 1927.....	311
Fig. 170.	Little Tupper Lake, Whitney Park, from Buck Mountain forest fire observatory at Ten-Mile Mark. February 14, 1930.....	329
Fig. 171.	Looking north on Whitney Park from the Buck Mountain tower. Forest in the middle ground provides good deer cover. February 14, 1930.....	329
Fig. 172.	Buck Mountain at the Ten-Mile Mark, Whitney Park. February 15, 1930.....	330
Fig. 173.	White and Scotch pines along the road between Whitney Headquarters and Ten-Mile Mark. Deer which frequented the feeding station at Headquarters used this for cover. February 15, 1930	330
Fig. 174.	Feeding station for deer at Whitney Headquarters; shed where alfalfa was fed, and trough for mixed corn and oats. March 3, 1930	333
Fig. 175.	Hay for the deer, Whitney Park. This splendid team and their driver were employed many days during the winter hauling provender to the half-dozen feeding stations in the park. March 19, 1931.....	333
Fig. 176.	Outlet of Little Tupper Lake, Whitney Park. The water here seldom freezes, and then not more than about an inch in thickness. March 14, 1930.....	334
Fig. 177.	Swamp seen from the bridge over the outlet of Little Tupper Lake. The ice here rarely becomes strong enough to support the weight of a deer, and numbers of the animals are drowned in winter when crossing the outlet from this swamp. February 14, 1930.....	334
Fig. 178.	The fence enclosing small cedars set out at Whitney Headquarters was high enough to prevent deer jumping over, but did not deter one from crawling through, as the tracks show. February 14, 1930.....	337
Fig. 179.	Plantation of Scotch pine at Sperry Pond, Whitney Park, making good cover for deer and used as a feeding station. March 2, 1931.....	337
Fig. 180.	Bog River, near Hamilton—St. Lawrence County line. Such streams are open through the winter, due to their swiftness, so that water is not a problem with deer in this region. March 18, 1930.....	338
Fig. 181.	Alders along Bog River, St. Lawrence County. Deer fed on these alders before the ice went out, stripping the bark in places. May 5, 1930.....	338
Fig. 182.	Feeding of alfalfa to deer at Six-Mile Mark, Whitney Park. The watchman here stood the bale on end and fastened it to a tree. March 16, 1930.....	341
Fig. 183.	Residue of hay at Six-Mile Mark feeding station at the close of winter. April 25, 1931.....	341
Fig. 184.	Scotch pine browsed by deer at Sperry Pond, Whitney Park. March 2, 1931.....	342

- Fig. 185. Balsam felled by wind and cut up for convenience of deer at roadside near Sperry Pond. Deer were fed hay a few rods within the forest at this point, but left it untouched until the balsam foliage was all consumed. March 19, 1931..... 342
- Fig. 186. Fringe of cedars along Mohegan Pond, Whitney Park, showing the line supposedly caused by browsing deer. March 6, 1930. 345
- Fig. 187. A spot where deer in the burn near Big Brook had pawed through the snow to reach dead vegetation. March 5, 1930.. 345
- Fig. 188. Balsam and spruce forest near Camp Craig, Whitney Park. A heavy fall of snow makes good cover for deer while it lasts. March 12, 1930..... 346
- Fig. 189. Mixed forests after a heavy snowstorm near Flatfish Pond, Whitney Park. March 12, 1930..... 346
- Fig. 190. Method of fencing against deer used by watchman at Round Pond, Whitney Park. April 18, 1930..... 349
- Fig. 191. Hay scattered for deer at Sperry Pond. Compare with the method used at Six-Mile Mark (Fig. 182). Deer utilize a scattered bale with less waste than if all of it is left in one spot. February 28, 1930..... 349
- Fig. 192. Watering place used by deer on Big Brook, Whitney Park. March 5, 1930..... 350
- Fig. 193. Mountain ash on Hamilton Mountain, on which deer had been feeding. February 23, 1931..... 350
- Fig. 194. Small stream near Wells, N. Y., showing how some streams have open water in severe weather. February 19, 1931..... 353
- Fig. 195. Deer here pawed through the snow to a frozen puddle, apparently searching for water. February 18, 1931..... 353
- Fig. 196. Road between Speculator and Indian Lake, showing the depth of snow at this season. February 18, 1931..... 354
- Fig. 197. Looking east from tower on Blue Mountain. The lakes are still frozen over at this date. April 5, 1930..... 354
- Fig. 198. Cold River near foot of Long Lake, with Seward Range in background. May 2, 1930..... 357
- Fig. 199. In the burn along Cold River. Ordinarily considered the summer range of deer, the animals were found here much of the winter of 1929-1930, which was reasonably open. May 2, 1930 357
- Fig. 200. Dead buck frozen in the ice near the outlet of Long Lake. This deer had been here ten days, during which time there had been a thaw followed by a cold snap. No marks of violence were discernible. Apparently it had fallen on slippery ice, was unable to gain its feet and froze to death. March 1, 1930. 358
- Fig. 201. Witch hobble near the foot of Long Lake. Deer browse extensively on its buds during late winter. April 22, 1931.... 358
- Fig. 202. Maples peeled by deer along Fishing Brook near Long Lake. April 14, 1930..... 361
- Fig. 203. Showing where deer had dug through the snow and surface litter to reach roots. Kempshall Mountain near Long Lake. April 25, 1930..... 361
- Fig. 204. Buttermilk Falls on Raquette River, at the head of Long Lake. There is open water here all winter. April 5, 1930..... 362
- Fig. 205. Cedar browsed by deer at Buttermilk Falls, Raquette River. Snow may have protected the foliage near the ground. April 11, 1931 362
- Fig. 206. Looking across a Long Lake spruce forest to Kempshall Mountain. This mountain provides much mountain ash for deer. March 20, 1930..... 365
- Fig. 207. Type of hay feeding-shed used on the Nehasane Preserve. March 22, 1930..... 365
- Fig. 208. Deer came to the kitchen door at Nehasane Park for potato peelings and other refuse from the table. March 22, 1930... 366

	PAGE
Fig. 209. Grain trough at the Nehasane Park feeding station. March 22, 1930	366
Fig. 210. "Granny" at Nehasane Park. This old doe had been coming to this feeding station for over ten years and became extremely tame. March 22, 1930.....	369
Fig. 211. Deer following lumbermen as they cut the hardwoods browse from the tops of the fallen trees. Brandreth Preserve. February 18, 1930.....	369
Fig. 212. This hemlock had been recumbent for a number of years, but deer came to glean lichen from its dead branches. February 17, 1930	370
Fig. 213. Cedars along Courtney Pond near North Hudson. Note that some branches are dead as far as the so-called "deer-line" while others have foliage clear to the water. April 15, 1931..	370
Fig. 214. Pulp logs on the ice at Lake Sanford, Tahawus, N. Y., ready for spring floating. This is in good deer country and it is believed by many residents that pulp-lumbering operations rob the deer of good yarding swamps. March 14, 1931.....	373
Fig. 215. Hudson River near its source, the outlet of Lake Sanford, Tahawus, N. Y. March 12, 1931.....	373
Fig. 216. Carcass of fawn caught between v-shaped forks of a small cedar. The remains were partly eaten by foxes. March 13, 1931...	374
Fig. 217. Forelegs of fawn above, indicating how it had worked itself into a position from which it could not be extricated. March 13, 1931	374
Fig. 218. Rock River between Blue Mountain Lake and Indian Lake village. Snow comes to the water's edge on the south bank, while the north bank with southern exposure is comparatively free of snow. April 9, 1931.....	377
Fig. 219. Portion of Summer Stream after a few days of thawing. In the heart of the Hamilton County deer country. March 27, 1931.	377
Fig. 220. G. A. Kenwell with doe which he ran down on snowshoes. This is possible in late winter when snow is deep and the animals are weakened by lack of food and the rigors of winter. March 27, 1931.....	378
Fig. 221. The melting snows of March expose many fawn carcasses that have been covered since early winter. Many are partially eaten by foxes. March 24, 1931.....	378
Fig. 222. Emaciated carcass of a large buck in the Moose River area; typical of the many carcasses found. March 24, 1931.....	379
Fig. 223. South Branch of Moose River, north of West Canada Lakes. It was along this stream that G. A. Kenwell and the author found over 70 carcasses in three days. March 24, 1931.....	379
Fig. 224. South slope of a knoll along South Branch of Moose River, Hamilton County. These southern exposures lose their snow with the first thawing days, and weakened deer seek them after the chilly spring nights. March 24, 1931.....	380
Fig. 225. Dead fawn found along the bank shown in Fig. 224. Many dead deer were found in such situations. March 24, 1931.....	380
Fig. 226. A four-inch fall of snow which came at Raquette Lake, April 27. This heavy, wet snow is inimical to the early born fawns. April 28, 1931.....	383
Fig. 227. A dead fawn at one of the hay sheds in Nehasane Park. Even with an abundance of food provided, many fawns can not withstand the extremes of temperature which come in the spring. March 22, 1930.....	383

MAPS

PAGE

Map 3.	Areas studied in the Big Moose and Brandreth regions. Adapted from the U. S. topographical map.....	<i>At end</i>
Map 4.	Areas studied in the Old Forge region. Adapted from the U. S. topographical map	<i>At end</i>
Map 5.	The Piseco Lake region. The rectangular area at the left center represents approximately 10 square miles. Modified from the U. S. topographic map and enlarged 2x.....	<i>At end</i>
Map 6.	Little Tupper Lake region. The area surrounded with a heavy black line in the center of the map represents about 20 square miles where most of the intensive studies for this region were made. Modified from the U. S. topographic map and enlarged 2x	<i>At end</i>
Map 7.	Diagrammatic sketch illustrating "seasonal localities" and total "life range" of a deer on the western shore of T-Lake. Adapted from the U. S. topographical map.....	319
Map 8.	Long Lake and Whitney Park areas. Feeding stations are indicated by the symbol "F" and the numbers preceding the symbols refer to the approximate number of deer visiting these stations. Approximate boundaries of deer yards visited are indicated with broken lines. Area number 1 represents a summer range of deer in the Grampus Lake burn; area number 2 a summer range in the Cold River burn. Adapted from the U. S. topographical map.....	<i>At end</i>
Map 9.	Moose River region showing deer yards visited and the number of dead deer found. Seventy-six dead deer were found during the last week of March, 1931, in area number 1. Forty-eight dead deer were reported by a forest ranger from area number 2. Adapted from the U. S. topographical map.....	<i>At end</i>



PLATE 4. WHITE-TAILED DOE WITH TWIN FAWNS

THE WHITE-TAILED DEER OF THE ADIRONDACKS

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CONTENTS

	PAGE
Part I. Preliminary Survey of the White-tailed Deer of the Adirondacks.	
Introduction	162
Regions studied	166
Adirondacks in general.....	166
Old Forge, Big Moose and Brandreth regions.....	167
Piseco region	174
Little Tupper Lake region.....	175
Life history of the white-tailed deer of the Adirondacks.	180
Haunts in summer.....	188
Late spring and summer food.....	192
Winter food	208
Food as a factor governing local activity and migration	211
Scatology	213
Population studies	214
General data	214
Deer population	218
Mortality	231
Accidents and disease.....	231
Hunting	232
The Buck Law.....	235
Some theoretical effects of hunting.....	237
Winter conditions	238
Relation of deer to man.....	241
Part II. Ecology of the White-tailed Deer in Summer, with special reference to the Adirondacks.....	247
Introduction	247
Analysis of summer habitats.....	254
Bed spots	254
Runways	259
Feeding grounds	264
Loitering grounds	266
The favorite summer habitat.....	270
Winter habitat	271
Daily rhythm	275
Length of feeding period.....	278
Influence of light.....	281
Individual behavior of the white-tail.....	283
Normal undisturbed behavior.....	283
Disturbed behavior	290
Social habits of the white-tailed deer.....	302
Social groups among deer.....	302
Relation of deer to other animals.....	309
Insect pests	313
Home range and life region.....	314
Bibliography	320

PART I. PRELIMINARY SURVEY OF THE WHITE-TAILED DEER OF THE ADIRONDACKS

INTRODUCTION

The present report on Adirondack deer is part of a program of deer study initiated by the Roosevelt Wild Life Station, and covers a reconnaissance extending through June, July and August of 1927, 1928 and 1929. Its purpose was that of a preliminary survey of certain phases of deer life which might be studied during the summer season. The work as presented here is admittedly incomplete and much remains to be learned at other seasons. After spending three summers in the field watching deer in their native haunts one still finds himself learning new facts about them on nearly every field trip, and is inclined to agree with one of the Adirondack guides who said that "you can spend a whole life-time in the woods and still see something new there."

The white-tailed deer has for years been the most important large game animal in the eastern part of the United States, and in New York State the hunting of this species has been a major sport since early days. A good deal has been written about the animal by various authors, but no extensive study has been made in the Adirondack section. Any such area may yield new facts about a species when carefully studied, and local conditions may have their effect upon the habits, food selection, abundance and ecological relationships of the animal. The present study has touched five different localities in the Adirondacks, but it is realized that the conclusions may not hold for other sections, for the deer is above all a very adaptable animal. Three summer seasons are a relatively short time to study the white-tail, and accordingly we have attempted to supplement our own observations by judicious questioning of natives in the regions studied and by reference to the printed literature on the subject. The literature has been particularly useful in writing the accounts of the activities of deer at seasons other than the summer months.

Throughout the *Bulletin* an attempt has been made to interpret and correlate the observations of habits and habitats from an ecological point of view and to show the adaptation of the animal to its surroundings. Section 2 of the *Bulletin* deals particularly with some of the broader ecological concepts which have been worked out. From the nature of the animal the study necessarily has been



Fig. 75. A general view of T-Lake and surrounding country, taken from the top of T-Lake Mountain.



Fig. 76. Blackfoot Pond. A great many deer tracks were found on the grassy flat. June 9, 1927.



Fig. 77. Along the Beaver River Flow near Brandreth. This gives an idea of the type of shore line formed as the water recedes in the summer. The doe shown in the view was at the time feeding on raspberry leaves. July 26, 1927.



Fig. 78. The set-back along the outlet of Falls Lake, Brandreth. In the spring this is entirely overflowed, but as the summer progresses the lowering water leaves a mud flat with innumerable pools in which the algae grow profusely. August 15, 1927.

observational rather than experimental and in many respects the work will bear rechecking at some future time.

While the viewpoint has been primarily ecological, it is possible that some practical aspect may be forthcoming. The white-tailed deer is today an animal of considerable value to human interests through various sections of its range, and any facts that we may learn in regard to it may be of real use in preserving and propagating the animal in the future.

The data gathered for this report were, from the nature of the problem, of the purely observational type. Experiments on wild deer are rather out of the question in so short an investigation. In general the method of study consisted of a more or less systematic series of field trips into the woods, observation of tracks and signs found, and watching of deer through field glasses. Lake shores proved to be very favorable points of observation during the early season when the deer were feeding there very frequently. In some places special trails were cleared and rough blinds of bushes constructed at favorable points about the lakes. The observer aimed to approach quietly in the early morning, at dawn or soon after, and remain hidden for several hours while watching the deer feed on the opposite shore. Careful notes were taken, recording the activities and mannerisms of the deer, the weather, time of day and other factors which might have some significance in interpreting the observations. Other data were obtained along the trails leading to the observation points. For example, the senior author during the summers of 1927 and 1928 made numerous trips at dawn over the trail from Piseco to T-Lake and saw or heard deer at certain points along the trail. Often the only indication of the presence of the animal would be the sound of its hoof-beats as it hurried away. In the dim light of dawn this might be the only item noted, but such observations were carefully recorded. Often longer overnight trips, requiring an improvised shelter camp, were made to enable the observer to be in a remote region at dusk and at dawn. Occasionally the two observers would approach a lake from different directions and then compare notes on what they had seen, or again they would watch in two different localities during the same hours. In the summers of 1928 and 1929 it was deemed best to avoid visiting a given lake two days in succession; accordingly a rotation method was used and various localities were visited once every few days. Tracks, runways, feeding places, dung, torn stumps, and other signs which might reveal, directly or indirectly,

some facts of significance regarding the daily life of the deer were recorded and photographed whenever possible.

The authors wish to express their appreciation to the staff of the Roosevelt Wild Life Station who have made this study possible and have aided and encouraged its progress in various ways. We are also indebted to numerous guides, game protectors and other friends in the Adirondacks for their cooperation and to the owners of Nehasane Park, the Brandreth Estate and the Whitney Estate for permission to study on their grounds.

REGIONS STUDIED

Adirondacks in general. The region of the Central Adirondacks lies mainly in the Transition Zone of Merriam. Most of the localities studied by the authors were in heavily wooded sections of mixed hardwoods and conifers. Lakes are numerous and mountain peaks rise to heights of two or three thousand feet above sea level. Figure 75 shows a view of T-Lake taken from the fire lookout tower on T-Lake Mountain near by, and gives a very good idea of the general topography of the land. Figure 97 shows a similar bird's-eye view of the region near little Tupper Lake. The mountain slopes and valleys are almost entirely covered with forest, broken here and there by small brooks leading into or out of the many small lakes. Numerous swamps occur, usually completely overgrown with alders and only occasionally showing stretches of open grassy marsh or quaking bog. Along the shores of the lakes is usually a stretch of low hummocky swamp where the common trees are spruce, hemlock and birch, while farther inland and on the mountain slopes beech and maple may predominate, probably representing the climax forest of the region. On the more level mountain tops the evergreens are again in evidence, mixed with the hardwoods. These vegetation belts are much intermingled and grade into one another everywhere. The lakes frequently visited by the deer are more or less of the Blackfoot Pond type (Fig. 76). The surrounding shores support the usual mixed hardwood and softwood trees with their underbrush, principally witch hobble and moosewood, which in turn gives way nearer the water to a shorter growth of laurel. The water margins are bordered by rather flat areas that support short grasses. On these flats, especially, were to be seen innumerable deer tracks. Pond lilies and water grasses (notably deer grass, *Eriocaulon*) were found in the shallow water, on which deer were seen on different occasions to be feeding.

Old Forge, Big Moose and Brandreth regions. During the summer of 1927 the junior author was occupied in studying a section of the western Adirondacks, comprising the territory along the line between Herkimer and Hamilton counties, from Old Forge on the south to Brandreth on the north (Maps 3 and 4). Selected sections in this region were studied at different times during the summer.

The region around Old Forge is rather thickly settled and it was possible here to observe the effects of human disturbances on deer. As indicated on map 4 the region is characterized by numerous lakes and ponds, and sluggish, winding streams. The thickets along the shores of these streams afforded ready hiding places for deer and the swamps and shore-lines yielded an abundance of food. In such a region deer may live rather close to human habitations, yet be seldom seen. Thus at Nicks Lake, only a little over a mile from Thendara, deer were habitually feeding along the shores in early summer.

The localities in the Old Forge region may be roughly divided into four groups according to the order in which they were investigated: (1) the Fulton chain of lakes with Third Lake Creek and Nicks Lake; (2) Big Otter Lake together with the South Inlet and Indian Brook; (3) Half Moon, Blackfoot, East, and Little Simon ponds; and (4) the lower reaches of the north branch of Moose River and Gibbs Lake.

(1) Observations were made on the first three of the Fulton chain of lakes. Roads skirt both the north and south shores and are well travelled. Old Forge is situated at the outlet of First Lake, and several cottages have been built at different points on all three lakes. In view of this, it is not surprising that no deer and few signs were encountered along their shores.

A trail starts from the north road and follows Third Lake Creek for some distance. For about the first mile the stream runs through a well-wooded area, beyond which, however, it flows through and drains a swampy tract.

Nicks Lake is also open to much disturbance. It is partly within the limits of the Adirondack League Club's holdings. The shore line is well wooded to the water's edge, except for a swampy area at the southern end.

(2) A good trail—an old tote road—begins at the railway track a short distance above Thendara and leads back to Big Otter Lake, past Big Moose Mountain, crossing Indian Brook, and following in a general way the course of the South Inlet. On the lower part

of Indian Brook are two beaver ponds. The adjacent land is the site of a comparatively recent burn and is covered with clumps of saplings, principally white birch (*Betula alba*) and poplar (*Populus tremuloides*), while the open areas support luxuriant growths of bracken (*Pteris aquilina*) and raspberries (*Rubus* sp.).

There was quite a clearing where South Inlet and the trail emerge at the lake. Only the shores on the southern part of the lake were explored. These were rather open, as the vegetation on them was sparse. There was no extensive shallow water with emergent aquatic plants, in which deer are so commonly encountered in the summer months.

(3) Half Moon, East, and Little Simon ponds were dammed by beaver. At least two aspects of the result of the inundation of shore lines are exemplified by these three ponds. Half Moon Pond, set in a more or less open area (probably a continuation of the burn mentioned around the beaver ponds on Indian Brook) had evidently been a small body of water with low-lying shores, practically devoid of timber, so that the damming of the outlet had flooded considerable land, but without affecting many trees or saplings. It was observed that deer could wade well out into the pond. Little Simon Pond is in the same category, but the water now reaches the edge of the woods, and has affected a few trees. On the other hand, East Pond is of a type where, previous to the damming, the woods and the water had met without any intervening open stretches. Damming has therefore resulted in the pond being surrounded by a belt of dead timber from a few feet to several yards in width.

Blackfoot Pond (Fig. 76) is not beaver dammed. This is a shallow body of water, narrow in proportion to its length and U-shaped. It shows an advanced stage of silting in, and transitions from pure aquatic to true terrestrial communities are illustrated. There are beds of rooted aquatics, an open bog flat, and a shrub margin. The open bog flat might be termed a vly, although as yet it is springy to walk upon and covered with only short grasses and sedges. This bog is frequented by deer, as shown by innumerable tracks.

(4) It is possible to paddle a canoe up the lower part of the north branch of the Moose River. There is a short portage just above Old Forge, and also a dam near the railway marker, Moulin. Above this dam a pond has been formed surrounding which is an area covered with shrubs typical of such a moist habitat. From Moulin a trail leads to Gibbs Lake, the shores of which are well wooded but rocky. The water supply for the village of Old Forge is taken from this lake.

The Big Moose region may be divided conveniently into the following sections: (1) Twitchell Lake with the nearby ponds and lakes, namely, Buck, Thirsty (Ainsworth), Snake, Silver, Razor-back, and Squash; (2) Big Moose Lake and its inlet, Gull Pond, Andes Creek, and the two Sister Lakes; (3) the Raquette trail, along with the bodies of water reached from it, namely, Mays, Constable and Chub ponds, and Queer and Pigeon lakes; (4) West and Big Safford ponds; and (5) Little Independence Pond and its inlet.

Twitchell Lake is a small summer resort, having a hotel and several cottages on its shores. The adjacent ponds and lakes listed above are similar in appearance, all lying in a well timbered region covered by evergreen and deciduous trees. Most of them are shallow and there are numerous beds of emergent aquatic vegetation. The margins are typically fringed with a border of alders (*Alnus* sp.), sweet gale (*Myrica gale*), and members of the heath family (*Ericaceae*). Thus, there are many examples of the aquatic and semi-aquatic habitats commonly sought by the deer in the summer season. However, comparatively few deer were seen in that vicinity. Often a greater number of fishermen were seen in a day than one could hope to see of deer.

Big Moose Lake is also a summer resort, but the low-lying and swampy area of the inlet is rarely disturbed by summer visitors. A short trail runs from the inlet to the Gull ponds and Andes Creek beyond. South Gull Pond is dammed by beaver, and near the outlet is a small shallow bay out of which deer were started on each expedition. A trail also leads from the inlet to the two Sister Lakes, proceeding for the first mile or so over gently rising swamp lands covered by a good growth of balsam (*Abies balsamea*) and spruce (*Picea canadensis*). The Lower Sister Lake is beaver dammed, yet the rise of water is slight. The Upper Sister is surrounded by a predominant evergreen growth, and due to the more extensive growth of aquatic plants, proved the better of the two lakes about which to observe deer.

The Raquette trail has been blazed by the State from near Higby's camp on the south shore of Big Moose Lake in a north-easterly direction to Raquette Lake, a distance of thirteen miles. It is of interest to note that along part of this trail (south shore of Constable Pond) there still remains considerable virgin timber. Here are large trees, with comparatively little undergrowth. Due to the activity of beaver, the water has been raised in this pond, and there are many dead trees, especially at the outlet. Queer Lake and Mays

and Chub ponds may also be reached by paths branching from the Raquette trail. In general the region about these waters is thickly wooded, and investigation revealed but little deer activity here.

Access to Big Safford Pond may be had either by a short blazed trail from the railroad on the west, or by one from West Pond on the northeast. The pond and its environs are considered a typical summer haunt of the white-tail. At the outlet is an open vly covered with tall grass and clumps of shrubs. At both the inlet and the outlet extensive beds of the yellow pond lily (*Nymphaea advena*) occur in the shallow water. As might be expected, the bottom under these beds is composed of a soft ooze, but such a condition did not deter the deer from feeding there. The east shore is low and extends back some distance from the water's edge. It is covered with a thick growth of sweet gale, laurels and alders. The west shore, in part, is pebbly, and, except for a narrow strip of shrubbery, abruptly meets the tree line. The surrounding woods are well undergrown with saplings, witch hobble (*Viburnum alnifolium*) and moosewood (*Acer pennsylvanicum*).

Little Independence Pond and inlet was visited only once. This section is owned by the International Paper Company and has been lumbered. In the woods is a maze of old tote roads and the underbrush is very thick. The pond itself is in an advanced stage of silting in; the immediate shore-line is of a boggy nature. Deer signs were plentiful, but the conditions made observations difficult.

The Brandreth region afforded the best localities for seeing deer in larger numbers. Here the major part of the land is privately owned, comprising Nehasane Park and the Brandreth tract. On these properties only the owners and their friends may legally hunt game; and so game protection is much more rigorously enforced. The effects of this were at once apparent, for the deer population was greater here than it was on most of the State-owned land visited.

Beaver River Flow (Fig. 77) is unique amongst the Adirondack habitats examined. The original river has been dammed for power purposes. The land is cleared to the high spring water mark with the result that, during the summer, as the water recedes, many stagnant pools and bayous are formed among the stumps and driftwood. Such warm shallow water produces an excellent growth, in many places, of filamentous algae, principally Chlorophyceae. The water of the flow itself had little movement, and during August a heavy "water-bloom" developed; and the bryozoan, *Pectinatella*



Fig. 79. Nehasane Lake. This is an example of a typical lake frequented by deer. Notice the low-lying shore lines and beds of pond lilies in the shallow water. August 20, 1927.



Fig. 80. T-Lake from the south shore.



Fig. 81. The west end of White Birch Lake, showing submerged bushes where deer waded.



Fig. 82. Scotch Lake, Piseco.

magnifica, typical of reservoirs, was abundant on the submerged branches and twigs. Also, as a result of the receding water, comparatively large open stretches are formed along the flow proper, as well as numerous set-backs where tributary streams enter. These set-backs proved best for studying deer. The open set-back along the outlet of Falls Lake (Fig. 78) is typical. Here is a more or less enclosed area of about thirty acres, with stumps and dead alders, amongst which algae grew profusely in stagnant water. The greatest number of deer in view at any one time (twenty-four) were seen at this spot feeding on algae, on July 18, at six p. m. The animals had well beaten paths leading down to the place and habitually fed there until the water fell and the algae disappeared. Even then, they evidently liked to roam over the open ground, browsing on whatever food they might find. Since the flow is of recent origin, the shores are not covered with a growth of small shrubs typical of the lakes in the Adirondack region, but the open stretches end abruptly at the woods.

Thayer Lake, Rose, Deer, and Shingle Shanty ponds are on the Brandreth tract. Rose Pond can be reached either by the Albany road—reported to be an old military trail, now much overgrown—or by the cleared boundary line of the tract. The other three ponds are reached from the road which extends back to Brandreth Lake. Rose Pond is quite secluded. The immediate shores, for the most part, are low-lying. Emergent aquatic vegetation is abundant. Thayer Lake and Deer Pond are also of this character. Lumbering operations were taking place in the vicinity of Shingle Shanty Pond. Where investigated, the bottom of this pond near the shore is of a rocky or pebbly nature. Deer signs were not common.

Nehasane (Fig. 79) and Rock lakes are in Nehasane Park. The southern shore of the former is low. There are large beds of the yellow pond lily as well as of the white (*Castalia odorata*), both intermingled with potamogetons. Deer were commonly observed feeding upon the lilies during August. The northern and larger part of the lake does not provide such areas, and the shores are here largely barren of smaller vegetation. Sand beaches are present. The entire lake lies in wooded territory. As a whole, this lake and vicinity proved one of the most fruitful localities for the present investigation.

Rock Lake is also, as stated, in Nehasane Park. As its name implies, it has a rocky shore line, and except for one small bay, there is a scarcity of food plants. Consequently, deer did not frequent its immediate borders.

There is a good trail along the outlet of Salmon Lake that leads to Witchhopple Lake and Beaverdam Pond. A summer camp is located on the latter pond and several fishermen were encountered on each trip to these localities. Two small beaver dams and ponds on the streams flowing into Salmon Lake and its inlet are more out of the way. Deer were seen and signs were abundant about these places. The whole general region is well wooded.

Piseco region. During the summer of 1927 one of the authors located at Piseco, while during the 1928 season both worked together in this region. Map 5 shows the territory covered during these periods. None of this territory is enclosed in a private park and all of it is intensively hunted each year. In general the section is more mountainous than are those mentioned above.

The shores of Piseco Lake are now rather thickly dotted with cottages and summer camps, and at the east end is the village of Piseco. Although deer are occasionally seen near by, and now and then are known to swim the lake, in general one must go farther into the woods or visit the smaller lakes in order to find the animals in this section. A chart (Map 7) shows the smaller lakes visited during the course of our field work. Many of the lakes in this region have a steep eastern shore, but lower ground along the western. Two general types of lakes may be distinguished. T-Lake (Fig. 80) and White Birch Lake (Fig. 81) are examples of lakes which have a relatively firm shore line with occasional bits of swamp adjoining, and with the steeper shore to the east. In this same class might be put Twin Lakes, Scotch Lake (Figs. 82 and 83) and Jessup Lake. Another type, illustrated by Cold Stream Lake (Fig. 84) and "L. D." Lake (Figs. 85 and 86), is characterized by more swampy conditions along most of the shore, with larger patches of laurel and other shore bushes in all parts. In these two lakes, again, the steeper shores were to the east, rising as a decided cliff in the case of "L. D." Lake. Most of the shore of this lake consists in late summer of a wide mud flat, while Cold Stream Lake is bordered by more marshy shores; both are flanked by alder swamps. Vly Lake (Fig. 88) is in another class, perhaps intermediate between the other types. On the east is the usual high ground, Vly Lake Mountain, while on the west the shore is low and bordered likewise by alder swamps. On the north is a wide stretch of open "vly", or tall grass meadow. Fall Lake is almost entirely surrounded by bogs and alder swamp (Figs. 89 and 90).

Most of the above mentioned lakes are or have been occupied by

beaver colonies and these have dammed the outlets, thus raising the level of the water and fringing the lakes with a ring of dead and dying trees (Figs. 92, 93 and 95). This was less noticeable on T-Lake, because of its size, and on Fall and Vly lakes the appearance was not noticeably changed by the beavers, although small dams occur on Fall Stream below Fall Lake. Two smaller lakes in the region, which were apparently untouched by the beavers, are Warner and Lizard (Fig. 94) lakes. Both are quite elevated in position and hard to be reached by the beavers; and both occupy shallow depressions near the tops of mountains and are characterized by grassy shore lines.

On the north shore of Vly Lake occurs the type of swamp which gives the name to the lake. The "vly" is an open swampy meadow, covered with a rank growth of tall grass, and with occasional bunches of laurels or alders scattered over it. The grassy condition extends northward intermittently along Fall Stream and makes of this section a sort of grassy "veld" among the trees. Around Mud Lake, nearby, the vly becomes a quaking bog, with pitcher plants and orchids abundant. Another excellent example of such a vly is that of Dead Man's Vly southwest of T-Lake (Fig. 96), where a considerable area is occupied by grassy meadow and quaking bog, although far removed from any lake. Smaller vlies were seen here and there in other sections of the region.

Another type of swamp quite common is that of the alder swamp, where sections of low wet woods are filled with a tangle of alders and other vegetation. Most of the swamps indicated along the streams on the map are of this type.

Little Tupper Lake region. During the summer of 1929 the senior author spent three months observing deer in the region around Little Tupper Lake, in the northern part of Hamilton County, and within the limits of the Adirondack State Park. For the most part the study was made on the privately owned Whitney estate. The section as indicated on the map (Map 6) is a rather undisturbed stretch of wooded country, broken only by two public roads, one set of farm buildings and a few camp clearings. The mountains in general are low, and lakes and small ponds are numerous. There are considerable areas of low swamp and thicket, and many of the ponds are shallow and muddy. All the forest land with the exception of a strip along each lake shore has been lumbered at one time or another, many years ago. Beavers have been systematically trapped and hunted so as to prevent the killing of trees along shores

that might be flooded by their dams. Figures 97 and 98 are views of the region, taken from the fire lookout tower on Buck Mountain.

The exact localities covered by the survey are shown on the accompanying Map 6. In the northern part of the territory is a considerable area that was burned over about 1906 where tree growth has not become fully re-established. The area now is more or less open, with alternating low bushes, trees and open stretches of grass.

On the north shore of Sperry Pond alder thickets occupy much of the low ground stretching down to the water. Along the east shore of this pond, again, the forest has been untouched by fire, while on the west side, clearings around an old lumber camp are overgrown with a tangle of raspberry bushes. Sperry Pond has its outlet to the south by a long winding stream, soon joined by Bog Stream from the east. The resulting stream (Figs. 99 and 100) is wide, generally sluggish and flows by a tortuous route south to Little Tupper Lake. Alder thickets abound along its boggy shore, and in places alternate with considerable stretches of tall grass, formerly cut each year for hay (Fig. 101). Such a combination of thicket and swamp is always a favorite haunt for deer, and the evidence indicates that many are to be found in the territory at all times. In July they waded into the stream from places where the shore was grassy and fed on aquatic vegetation. They seldom entered the water from the alder thicket shores. (See Figures 102 and 103.) Perhaps the number is increased by the presence of a salt lick at Ten-Mile Mark near the outlet of Bog Stream. The lick is kept supplied with rock salt by the game protector and attracts many deer throughout the season.

Eastward from Bog Stream lies Buck Mountain where another small salt lick is maintained near the fire lookout station. The mountain is heavily wooded and a number of deer were living here all summer. Several fawns were seen or reported in the area.

Moonshine Pond (Fig. 98) lies to the east of Buck Mountain and is seldom visited by man. The northern shore is the site of an old burn and is heavily covered with ferns and small evergreen trees. The pond has its outlet eastward, through a swamp.

South of Moonshine lie the three Cat Ponds, all low, swampy-shored and surrounded by thickets. Grouse Pond is a similar small pond farther south.

A meadow just south of Ten-Mile Mark attracted deer during the early season, and animals were also seen occasionally in the unbroken woods along the old tote road and near the reservoir.



Fig. 83. A submerged alder swamp at the south end of Scotch Lake, the result of a beaver dam.



Fig. 84. Cold Stream Lake. Many deer here fed on the algae growing in the shallow water. August 10, 1928.



Fig. 85. "L. D." Lake as seen from the south. A beaver dam on the outlet has backed the water up into the low woods in the foreground, thus producing good summer feeding grounds for deer.



Fig. 86. The north shore of "L. D." Lake in summer. The wide mud flat was a favorite feeding ground for deer.

Numerous well-worn trails showed that deer were common in this district.

The east shore of Little Tupper Lake presents an almost unbroken stretch of forest, with numerous swampy areas around the bays. Between this shore and Stony Pond to the east is a broad expanse of more open, quaking-bog type of swamp.

Stony Pond (Fig. 104) for the most part has, as the name implies, rather steep and rugged shores, with a considerable amount of broken boulders, heaped in places. Off shore the bottom is mostly sand or rock. Conditions here, as would be expected, are not so favorable to deer. The same is true of Slim ponds (Fig. 105) in general, though a few deer were seen in some swamps at the west end of Big Slim.

South of Slim ponds lies a tangled thicket of second growth, broken by Rat and Robinson (Fig. 106) ponds. Here a number of deer were seen. Camp Craig to the south lies in a region of low swamps, and although deer were not often seen there, tracks and other signs indicated that the animals were numerous.

Several deer were seen around Flatfish Ponds (Figs. 107-109), and the territory around their eastern end, in particular, with its beds of lily pads, low grassy shores and flanking low alder thickets, offers ideal habitat for deer.

Antedeluvian Pond (Fig. 110) is shallow and muddy, with grass-covered shores flanked by quaking bog and tamarack swamp. On the east side, however, a high dry ridge lies fairly close to the pond, and no doubt deer find here good bed grounds. The pond has its outlet to the west through a long grassy meadow and an alder thicket and thence into Little Tupper Lake. The region was visited too late in the season to see many deer around the lake shore, but the runways and the testimony of guides indicate that it is well stocked with deer, as might be expected.

Around the head of the lake, near Camp Bliss, stretches of swamp and alder thicket alternating with drier woods on the ridges furnish ideal deer country. The inlets from the south and west are sluggish streams with boggy shores. Farther north the inlets into Two Island Bay are similar in character. Otter Pond Creek through a long stretch is bordered by alternating grassy and fern-covered banks and alder thickets. It comes from Otter Pond, the shores of which also are low and grassy.

North of the highway lies Loon Pond, with shores for the most part rocky, but with some low borders on the southeast.

Round Lake presents a variety of shoreline. Rocky and steep on the north and west, the shore drops to the south and east into considerable areas of swampy thicket with dead trees due to an old dam. The inlet at the south drains Little Tupper Lake and is a low, wide and winding stream, choked along the shore with aquatic grasses and lily pads. Areas of sweet gale bog (Fig. 111) stretch back from the water's edge to the alder thickets, broken here and there by abruptly rising hillocks covered with evergreen trees and a dense growth of laurels. In the early summer many deer are seen here feeding on the lily pads in the stream or cropping the short vegetation below the sweet gale bushes, before retiring inland to their bed-grounds.

In general it seems quite true that if one were to examine an accurate topographical map of a given region in the Adirondacks one could point out with a fair degree of certainty the localities where most deer would be found. Ideal conditions are close to some lake that has a considerable amount of swampy or marshy shore flanked by drier ridges.

LIFE HISTORY OF THE WHITE-TAILED DEER OF THE ADIRONDACKS

Ecologically the most important part of the environment and habitat of a species is the place where the eggs are laid or the young are born, and the keynote to the physiology of the animal is to be found here. Shelford ('13, pp. 31-32) says: "The activity which determines the range of conditions under which a species will be successful is the activity which takes place within the narrowest limits. This is usually the breeding activity. The breeding instincts are the center about which all other activities of the organism rotate, and the breeding-place is the axis of the environmental relations of the organism." The physiological life history of the species begins when the mother picks out the place to bring forth her young.

Fawns. The fawns of the white-tailed deer are born in April, May or June, after a gestation period of a little over 200 days (Seton, '27, p. 258; Newson, '26, p. 142). At this time the mother leaves the company of her last year's offspring or any other deer she may be with, and alone seeks out the birthplace for her new fawns. According to Seton (*loc. cit.*), this is "On some island or in a thicket remote from sounds of alien life." A fallen tree-top seems to furnish a favorite place and this selection of close cover gives the keynote to the ecology of the animal. The white-tail prefers the thicket close

to the forest edge, rather than the virgin timber or the open clearing. One fawn is born by the two-year old doe and after that two is the normal number. For the first month the young do not wander far, but remain hidden in the thicket, visited several times a day by the mother for nursing. The mother is also said to spend the night with them. In a few weeks, however, the fawns begin to accompany the doe farther afield and by early summer they may be seen trotting by her side as she wanders along the shores. When danger approaches, the fawns skulk and hide in the underbrush, relying, according to some, on their protective coloration of spots to elude the enemy. At about four months of age the fawns are weaned, but continue to accompany the mother. According to Caton ('81, p. 308), the male fawn stays with her for one year only, the female for two years, with the exception of a month or so when the new fawns arrive in the spring. In the fall of the first year the fawns lose their spots and take on the grayish tan coat. By the next autumn the male fawns may have developed their first "spike-horn" antlers and are approaching maturity. The does may breed at eighteen months of age. (Seton, '27, p. 258.)

Summer habits. The life of the adult deer through the year varies with the seasonal changes in the weather, the food supply and the physiology of the animal itself. In the early summer, when the fawns have begun to roam about with their mothers, the deer in the Adirondacks seem to be scattered through the woods, wandering about in the stretches of witch hobble semi-thickets and alder swamps near the lake shores. Just how far they travel and whether they follow any regular routes in their activities at this time are questions hard to answer. Some of them are easily seen at this season about the edges of pastures and fields at dawn or dusk, but they do not seem to be coming to the lake shores so much. Observations in the fields near Piseco and near Old Forge at this season seemed to indicate a regularity in their daily life. Apparently the same animals, both bucks and does, were, by careful watching, seen again and again at the same points along pasture edges.

During the latter part of June and in early July the food conditions about the lake shores become more attractive and the deer take to traveling regular runways to and from these places, feeding there at regular periods determined by the local conditions. It is at this season that a daily rhythm in their activities is particularly noticeable.

About the middle of July the deer become less numerous about the lake shores and soon thereafter are scattered through the woods in

search of other sources of food, or in an effort to hide away from the summer hiking parties and fishermen who now are frequently met within the woods near settled sections. In this connection Newsom ('26, p. 5) states that hunters make a mistake in watching about lake shores for deer during the hunting season.

Breeding. In the fall comes the breeding season, when the activities of the sexual glands dominate the behavior of the animals. The bucks, the necks of which have begun to swell, wander through the woods, pursuing the does whenever opportunity offers, and fighting with any rival males they may chance to meet. The hunting season is open at this time and the numerous bands of hunters in the woods add to the excitement of the animals. For about two months the bucks seek the does, probably each one associating with several does during that period. The breeding season is said to reach its climax during November, after which the life of the deer becomes more quiet and the animals have a tendency to gather in groups and wander about. As the winter snows become deeper these groups may be more or less closely confined to certain localities, the winter yards, where their trails in the snow allow them to move about in a limited area in search of food. With the coming of spring the deer leave the yards and wander farther in search of the scant food. The yearly cycle then comes to a close.

Color. During the year, deer, like many other mammals, change their coat of hair. The fawns start out with a coat of reddish brown, spotted with white. As the summer advances the spots are gradually lost and the animal shows the gray-tan coat of fall. The older deer have a coat of reddish hue all summer and in the fall also change to the gray coat, and are then popularly said to be "in the blue". During the summer of 1928, at Piseco, the deer were apparently a bit slow in changing from the blue to the red coat, the first example of a good red coat being observed on a yearling buck on June 16. Probably this is rather late in the season for the change of coat in this section, and the reason may perhaps be found in the unusual amount of rain during the early summer of 1928.

The game protector in the Piseco district, Mr. Stanyon, reported having seen three cases of partial melanism during the fall of 1927, one of them quite dark. (Two cases of melanism in woodchucks, also, were found near Piseco.) Cases of albinism, occasionally reported among deer, were not noted in the sections studied.

Antlers. The antlers of the buck consist of bone instead of horn, and the word "horn" when used in this connection is therefore incor-

rect. The antlers are grown and shed each year. Starting as mere rounded knobs on the pedicles of the frontal bones of the buck they grow rapidly during the summer months and reach maturity before the breeding season opens. They are shed some time during the winter months. During their growth the antlers are completely covered with a layer of skin, continuous with the skin of the head. The short, soft hair of this skin is called the velvet. In the deep layers of the skin covering as well as in the interior of the developing bone of the antlers many blood-vessels furnish a rich supply of nourishment. In the case of young bucks (yearlings, especially) the antlers usually do not develop tines or "points" and such animals are called "spike-horns". In older bucks the number of points is variable and is by no means a criterion for determining the exact age of the animal. In advanced age or in feeble health the animal may grow antlers resembling "spike-horns" again. In the territory covered by the authors the most common number of points was six, with a few eight-point bucks observed, and occasional individuals with as many as nine or ten points. Usually the antlers of a white-tail tend to curve forward over the head. One large ten-point buck at Dead-man's Vly and another with nine points at Cold Stream Lake had antlers with heavy beams that rose more nearly vertically in an arch above the head.

In the fall, when the antlers are mature, the blood supply becomes shut off at the base, and the skin covering, deprived of nourishment, dies, and begins to slough off. The animals hasten the process by rubbing their antlers against saplings, often tearing the skin (or "velvet") into bloody shreds. When the velvet has been shed, continued rubbing tends to polish the bone. Opinions differ as to the reason why the buck rubs his antlers. Newsom ('26, p. 156) thinks it is in response to an itching sensation in the velvet. Mr. Jenkins, the game warden at Thendara, reported having seen a buck rubbing his antlers and was of the opinion that the animal did so because of his natural aggressiveness at this season, and with a desire to "fight something". On the whole it seems likely that both opinions may be in part correct. Probably the first rubbing is due to an itching sensation and that the last polishing of the antlers may be the result of the animal's desire to try his strength against something, usually a sapling.

During the summer of 1928 several examples of rubbed saplings were found near Vly Lake, in the Piseco region, obviously the work of some previous season. In most cases the saplings were small,

measuring about an inch and a half in diameter, likely to bend under the weight of the buck pushing them. One case, however, was that of a small tree about five inches in diameter. In each instance the sapling or tree was so located that the buck had an open place in which to stand, facing the tree. Each tree had a strip of torn and shredded bark on each side, from about one foot above the ground to a height of three feet. The bark was usually hanging in shreds from the lower edge of this strip, indicating that the buck had probably rubbed with a downward rather than an upward stroke. Figure 112 shows an example of a rubbing-tree.

The growth of the antlers is closely associated with the activity of the sex glands, and a castrated animal will develop only small abnormal growths at the best; these do not lose the velvet but usually freeze and break off in winter. This is well illustrated in figures 113 to 116 of a deer which had been kept in captivity by H. Rogers of Oxbow Lake, near Piseco, for several years. It was castrated after a time in captivity and thereafter grew only stub antlers.

The antlers of the buck are the chief means by which a field naturalist can recognize individual deer on different occasions. Careful notes on this point were kept during the present investigation. The antlers vary not only as to the number of tines or points but also as to their arrangement. The younger bucks show "spike-horns" consisting of a single slender, spike-like tine on each side. Several examples of "fork-horn" bucks were also noted during the three seasons of observation. In these the antler consists of two tines rising from the same base. Neither of the tines seems to be the equivalent of the brow tine in the six- or eight-point bucks. Deer with such antlers were observed at the west end of Slim Pond, on July 30, 1929, and at Stony Pond, on August 2, 1929. Indications were that these were two different individuals.

The antlers of a buck are by no means always symmetrical. A small buck was seen several times in the woods south of Ten-Mile Mark, during 1929, and on one occasion was observed closely at short range. It had one point on the right antler and two points on the left, each about seven or eight inches long. A six-point buck observed closely on the tote road near Robinson Pond, August 20, 1929, had six well developed points, but apparently no true brow-tines.

A few four-point bucks were seen, but the majority, as before stated, had six or eight points. Aside from one nine- and one ten-point buck seen in the field, we saw many trophy heads belonging to residents in the region, that had ten or more points. It is probable



Fig. 87. Small beaver pond on outlet from "L. D." Lake. Tracks of deer were numerous in the mud.



Fig. 88. Vly Lake. There is quite an extensive vly on the west shore shown in the view. July 30, 1928.



Fig. 89. Fall Stream between Fall Lake and Vly Lake. The shores here at many points are open, providing stretches of ground covered with a rank growth of grass. May 31, 1928.



Fig. 90. The lower reaches of Fall Stream, showing swampy, thicket-covered shores. Most of the shore was a quaking bog.

that some of the smaller points may be easily overlooked by anyone who studies deer in the woods in the summer when the antlers are in the velvet. Later in the season as the antlers take on their final development and the velvet is shed, the smaller points become more conspicuous. Two of the largest bucks seen in the region of Little Tupper Lake were not close enough for the points to be counted. These animals were seen at Camp Craig and in the hay meadows along Bog Stream, respectively. Both seemed exceptionally alert animals, and were more difficult to keep under observation than were others. One ten-point buck was seen at Dead Man's Vly, near Piseco, in 1928.

Aside from number of points there seemed to be, in general, two types of antlers, or rather two extremes of patterns with various intermediate types. In the one type the beam of the antler bends forward and upward rather close to the head, and if the tines are of good length the antlers of this type give a somewhat "bushy" effect when viewed casually. The opposite extreme is found in cases where the beams of the antlers extend laterally from the head, forming a wider spread, without so much of the forward swing. The deer with such antlers usually were large and apparently would have made fine trophy heads. A fine, eight-point buck of this type was seen on August 12, 1929, at Loon Pond, and on several occasions one of this kind, perhaps the same animal, was seen in a clearing close to the Sabattis road, two or three miles east of Loon Pond.

Another easily observed variation in antlers has reference to the length of the separate tines, some deer showing much longer tines than others. In the field it has been found useful to adopt a set of terms for describing quickly the nature of a buck's antlers, with reference to these three characteristics, namely, width, length of tines and number of points, listed in the order in which the characters are easily seen in the field. In describing the lateral extent of the antler three terms are useful: "wide", "average", and "close". In describing the length of the tines one may call them "long", "medium", or "short". Thus the description of the antlers of the buck seen at Loon Pond would be "wide, medium-tined, eight-point", while another buck seen at Robinson Pond had "close, medium-tined, six-point" antlers. Two of the biggest bucks seen in the Piseco region would be designated as having "wide, short-tine, ten-point" antlers, and "average, very long-tined, eight-point antlers", respectively. The best trophy heads would have wide, long-tined antlers with ten or more points.

Haunts in summer. Certain general conclusions were reached as a result of our search for favorable places for deer. The places most frequented by deer are selected, probably, primarily because of the abundance or the nature of food found in them. As the season progresses and this food disappears, these localities are deserted. As discussed in Section II of this bulletin, the deer is a forest-edge feeder, which is perhaps to be explained again by the fact that it is able to secure the preferred food around ponds and lakes and in, or bordering on, the more open places. Thus a deer foraging-ground is more or less narrowed down during the early summer months to the land adjacent to lakes, ponds and streams. Since there is usually an abundance of food near at hand they do not generally travel far away from such places, but remain within a radius of a mile or so of the feeding grounds. There are of course exceptions, but in speaking of the majority of deer this is doubtless true for the summer months at least.

Observations which corroborate the above conclusion were made along the trails, where the number of deer signs and the number of deer seen increased rapidly on nearing a body of water. For instance, on that part of the old "Albany Road" running from the railway tracks at Little Rapids back to Rose Pond, indications of deer were very scarce, and in many places not to be seen at all before one came within about three-quarters of a mile or less of the lake and its outlet. Another similar observation was made earlier in the season (during June) along the trail to Big Otter Lake at Old Forge. No tracks or other evidence of deer activity would be observed on the trail except in the immediate vicinity of a stream, or within a radius of less than a mile from the lake. The same was true along the trail from the inlet of Big Moose Lake back to the two Sister Lakes.

The swampy portions of the shore were frequented more than were other parts, for here grew the more succulent grasses, while pond lilies and other water plants were more abundant in the shallow water. The greater part of the shore-line of Nehasane Lake (Fig. 79), at Brandreth, was of this character, and around this lake deer were relatively numerous.

Deer were often seen at beaver ponds (Fig. 117)—those still inhabited by beaver as well as others which had long been deserted and had become "beaver meadows". Such places are of course more favored by deer earlier in the season when the shoots of various grasses and sedges are more tender and succulent.

The Beaver River Flow (Figs. 77, 118 and 119) deserves special mention in this connection. As stated before, Beaver River has been dammed, flooding areas of land that had previously been cleared of trees to the high water mark. During the summer the water level gradually is lowered, leaving mud flats with many stagnant pools. Algae grow abundantly in these pools (Figs. 78 and 120) as well as in the more quiet parts of the flow itself. These plants were found to be a favorite food of deer in that locality; the same was true of the raspberry (Fig. 118) which was abundant along the shores. There are many set-backs due to the inundation of the mouths of small streams, as well as other low areas where well worn paths indicated that they were often visited by deer.

The set-back along the outlet of Falls Lake (Figs. 78, 121) was the locality in which the greatest number of deer were found together at one time. As mentioned on page 173, twenty-four deer were seen here one afternoon, feeding within a space of about thirty acres. The wood back of this place was composed principally of such hardwoods as maple, birch and beech, with scattered clumps of softwoods on the lower flats. All through this locality to a radius of half a mile or more were criss-crossing deer trails in great numbers, packed hard by constant travel. Beyond the half-mile limit the trails became less distinct and more scattered, again indicating evidently that the deer were not in the habit of traveling very far from their foraging grounds in the intervals between feeding hours. Nearer the water the trails became larger due to the convergence of many trails ultimately into six main ones which finally led out to the set-back. At one point, where the widest and most heavily traveled trail left the woods, the drying mud around the stumps was packed hard by continual tramping of deer. The dead bark of the stumps had been scuffed off, and may have been done when the deer were feeding on the algae (Fig. 78) which clung to it when the water was at a higher level. In no other one spot did we find such clear evidence of frequent visits and intensive feeding activity on the part of the deer as here.

By the middle of August only two or three deer were still seen feeding at this place. The reason was simply that the water level had fallen, the pools had dried up and the algae had largely disappeared. With this food supply gone the deer sought a more favorable locality. This instance seems to show rather clearly how the local dwelling places of deer are sometimes selected because of the nearness and abundance of a certain food supply. Along this flow the number

of deer frequenting a set-back apparently fluctuated with the water level that determined the amount of algae available. And algae, it may be said, are sometimes an important item in the diet of deer.

In regard to the resting habits of deer and their activities during the periods when they are not feeding, some information was obtained. One spot was discovered along the flow where deer evidently had a stamping ground or retreat. This place was in a grove of pines where the ground was carpeted with needles. An area of about ten square yards bore marks and impressions indicating that deer had been standing about as well as lying down, after the manner of cattle in the shade of some tree on a warm summer day. Three well-defined trails led to the spot, and the hoof prints were recent. There were few droppings within the area itself, but more were found on the trails leading to it.

Among the alders near the inlet into Safford Pond, on two occasions beds were found where deer had been lying down. On June 29, 1927, a spot was found where three beds had recently been occupied, either by the same animal at different times, or by three different individuals. At Nehasane Lake, in August, 1927, in a comparatively open spot only a few feet from the shore, in tall grass, were indications that five deer may have been lying down, all within a few feet of each other; yet here, too, a single individual may have returned repeatedly to its bedding place. Other isolated instances were also noted where deer had rested in the grass on lower ground. Thus, although the trails leading away from the water indicate that the majority of deer go back, after feeding, to higher ground, there are usually some individuals that remain rather close to the water.

As stated above, deer feed usually in the shallow parts of ponds and lakes, or streams, or along their margins. Beaver meadows are also much frequented feeding grounds, as are the edges of clearings where various succulent food plants are found. Back of the saw-mill at Brandreth, for example, was a clearing where deer regularly came out to feed in the evening. But visits of this sort may not be solely for the purpose of feeding; perhaps the animals come also seeking something salty.

The time of feeding for the majority of the deer in the Brandreth section, as we found it, was late afternoon and evening; it was at that time that the largest counts of feeding individuals were made. An instance which shows how the number increases as the afternoon advances occurred on July 18, in the set-back along the outlet of Falls Lake. At noon there were here twelve deer feeding; at

3:00 p. m. there were eighteen; and at 6:00 p. m., twenty-four. Again, on July 26, twenty were seen in this locality at 6:40 in the evening. It is a well-known fact, of course, that the evening is the favorite time for many wild animals to feed, and it is evidently true in general for deer in many localities in the territory in question. The best time to see them then was from 4:00 p. m. until dark.

In some sections early morning and late afternoon were found about equally favorable for observations on the white-tail. This was true particularly in the Piseco region. In the Brandreth and Tupper Lake regions, as the summer advanced, early morning trips were practically useless on most days because of mists characteristically present, so that we had no opportunity to compare the morning with the evening period.

Near T-Lake in the Piseco region deer were decidedly more in evidence in early morning hours than later in the day. In the Brandreth region fewest were seen in the morning from 9 to 11:30; but at noon a number of does were usually seen coming out to feed. These does in all probability had fawns. In the afternoon, or at any other time of the day, more deer were found around such lakes and streams as were not visited frequently by people. During two days spent at the two Sister Lakes near Big Moose, almost as many deer came out in the afternoon as in the evening. But at such places as the set-back along the outlet of Falls Lake, where disturbance by man is more frequent, deer showed a marked tendency to come out more in the evening, just before or just after dark. The reduction in the number of deer feeding on the shores of certain lakes during the daytime in this region, is evidently brought about mainly by the appearance of fishermen at these lakes. If deer are frightened once or twice during their regular feeding hours they are likely to change their periods. Thus on Safford Pond at Big Moose there were few fishermen until July. Up to that time deer were commonly seen during the afternoon, sometimes as many as eight at one time; but after fishermen had made a number of trips to the lake, only one or two deer were usually to be seen.

Collectively it would seem that deer do not show any regularity in feeding hours, except in so far as they show a general preference for evening; but individually there is considerable regularity. At Thirsty Pond, west of Big Moose Lake, three does were in the habit of coming out to feed along the shore, evenings, during the latter part of June and the first week in July. Their visits were made with considerable regularity. The animals came out between 6:00 and

7:00 o'clock and would stay until dark unless there were fishermen on the lake to frighten them away. On two occasions we visited the lake at sunrise, but deer were not out either time. A doe that had two fawns came out at Little Rapids usually between 6:00 and 7:00 in the evening and from 6:00 to 8:00 in the morning, and browsed on the raspberry growth. In another instance a doe that fed in the set-back near Brandreth station usually appeared at about 3:30 in the afternoon. It waded around in the mud and water, feeding upon algae and young grass shoots.

The length of time that a deer will continue feeding doubtless varies considerably with the individual, with the abundance of food, or other factors. As a general observation it seemed that the deer remained out for a longer period late in the afternoon and in the evening than they did when coming out to feed earlier in the day. In the afternoon an average feeding period was about one hour; on the other hand, if a deer came out to feed at 6:00 or 6:30 in the evening, it was more than likely that it would remain at least until dark. How much longer it remained after that could not be determined. The fact that the individual deer remains out longer to feed in the evening is one explanation of why more are observed together at this time.

Late spring and summer food. It is not often that one finds a chance to observe a deer in the woods, chewing its cud, which it does while loitering or resting. At such times the animal is quiet and quickly becomes aware of any movements on the part of the watcher. We happened to see three bucks chewing cud, one at T-Lake, another at Little Tupper Lake, in early morning, and a third one in a clearing near the hotel at Piseco, at the noon hour. These deer were all standing. They chewed rapidly, not taking many moments for each cud. The buck seen near the hotel stood in a pouring rain and did not move out of his tracks for an hour, chewing his cud the greater part of the time. We may mention here a tame buck that we saw at Oxbow Lake, which chewed his cud while lying down.

During the late spring and summer months there is a great abundance and variety of tender food plants, and at this season it is not a difficult task for deer to find plenty of nourishment, in contrast with the winter months. As a result the animals choose only the best, according to their taste, and do not *generally* restrict themselves to one spot, but wander more or less widely, browsing a little here and there. Because of these habits the deer may be spoken of as a selective browser. Places have been noted where extensive crop-



Fig. 91. Section of low woods at east end of Little T-Lake, flooded by beavers. Deer were frequently seen wading among the dead trees and feeding below the water on deer grass, algae, etc.



Fig. 92. Grassy marsh on outlet from T-Lake. The result of beaver dams.



Fig. 93. The submerged woods at west end of White Birch Lake. The dead trees are the result of a beaver dam on the outlet of the lake. A favorite feeding ground for deer.



Fig. 94. Lizard Lake, showing grassy shores typical of a lake undisturbed by beavers. A seven-point buck is standing in the grass of the opposite shore near the center of the picture.

pings of blackberry had been made, but which, of course, may have been the sum total of several days' browsing of several deer. The deer, previously mentioned as feeding on algae along the outlet of Falls Lake, at Brandreth, during the season of 1927, came nearest to exhibiting a fixed habit of returning regularly to certain spots to feed, of any that were noted. They appeared to be quite content to feed in a relatively small area, instead of wandering around in the usual way. It has previously been stated that at Cold Stream Lake, in the Piseco region, in 1928, several deer came quite regularly, during the latter part of July and in August, to feed on the algae growing profusely at that season in the shallow water of the lake. There were not so many deer here as at Brandreth, but the habit was equally pronounced. Again, along the Spruce Lake trail at Piseco, we saw very extensive croppings of nettles. Here, in a beech-maple woods, large beds of this plant were growing and it was surprising to see the thorough manner in which the majority of these plants had been nipped off. However, these cases are the exception and not the rule. Usually the evidence of deer browsing is not so noticeable. At T-Lake, for instance, on different occasions deer were observed to feed on "deer grass" (*Eriocaulon*) and laurel leaves at the water's edge, and to swim out and feed on pond lilies. The menu of deer is varied to a remarkable degree, including a great many different forest plants at some stage of their growth. Many of these food plants have been listed by various authors. According to Newsom ('26, p. 5), "a deer will eat almost anything that is green. He is almost goat-like in the variety of food he consumes." However, it takes usually only the more tender and succulent shoots and leaves, so that a given plant may be sought eagerly while it is young but left almost untouched after it has reached maturity. Thus, witch hobble is taken early in the season, while it is budding or the leaves are young and tender, but later in the summer fresh croppings are rarely seen. In this way as the season advances different plants find a place on the list of deer food, while others, having lost their succulence, drop out. The white-tail is discriminating in its feeding habits and searches out the more tempting leaves and shoots. For this reason there usually is very little evidence that a deer has been feeding in a locality. In the field it is often quite difficult to find just what a deer has been feeding on, even though one may have been watching the animal closely and feeling quite sure he would be able to go to the spot and see the evidence; but when he reaches it there is, to his surprise, nothing that he can see. In a pasture

at Piseco, for example, deer were closely observed while they were thus feeding, but an examination of the spot revealed nothing. (Cattle were admitted to this pasture only later in the season.) Since deer crop only a little morsel here and there, it takes a longer time to secure their fill than the seeming abundance of food would lead one to suppose.

A number of plants eaten by deer are listed in this study. We proceeded on the assumption that any extensive croppings observed in the proper localities had been made by deer, and therefore not all the plants listed are species which we actually saw deer eat; but there is hardly any doubt that deer were the animals concerned. In most cases deer tracks among the cropped plants served as corroborative evidence.

The following is a partial list of food plants of the deer in the Adirondacks:

Wild red raspberry	<i>Rubus strigosus</i> Michx.
Wild blackberry	<i>Rubus villosus</i> Ait.
Sarsaparilla	<i>Aralia nudicaulis</i> L.
Algae	mainly <i>Spirogyra</i> sp.
Yellow pond lily	<i>Nymphaea advena</i> Ait.
White pond lily	<i>Castalia odorata</i> (Ait.) Woodville and Wood
Deer grass or pipewort	<i>Eriocaulon septangulare</i> (Huds.) Morong.
Witch hobble	<i>Viburnum alnifolium</i> Marsh
Moosewood	<i>Acer pennsylvanicum</i> L.
Bracken	<i>Pteris aquilina</i> L.
Poplar	<i>Populus tremuloides</i> Michx.
Choke cherry	<i>Prunus pennsylvanica</i> L.
Maple (hard and soft)	<i>Acer saccharum</i> Marsh, <i>A. rubrum</i> L.
Elderberry	<i>Sambucus racemosa</i> L.
Nettle	<i>Laportea canadensis</i> (L.) Gaud. (?)
Beech	<i>Fagus grandifolia</i> Ehrh.
Birch	<i>Betula lutea</i> Michx.
Laurel	<i>Kalmia</i> sp.

It seems appropriate to discuss some of these food plants, individually or collectively, and to add some remarks on certain other items of food or related habits.

YELLOW POND LILY (*Nymphaea advena*). Pond lilies (Fig. 122) along with raspberry canes appeared to be one of the chief items of deer food in the Big Moose and Brandreth sections, from the time of their first appearance and on through the summer. Lakes with good-sized pond lily beds were much frequented by the animals, which were often seen feeding on them, especially during the latter part of July and in August. In the Piseco area, with the exception of T-Lake, the lakes most frequented by deer did not have many pond lilies in them, so these plants in this region are necessarily not such an important item of deer food. But at T-Lake, where pond



Fig. 95. Milligan Vly, Piseco, showing mud shores and dead trees and alders as a result of flooding by beaver damming.



Fig. 96. Dead Man's Vly. A ten-point buck was observed to lie down in the open vly near the tree in the center, in early afternoon.



Fig. 97. From Buck Mountain Tower. Left to right: Little Tupper Lake, "The Slang." Round Pond (background), Bog Stream or Sperry Brook (right middle distance). July 15, 1929.



Fig. 98. Looking east from Buck Mountain Tower. Moonshine Pond to the left center. July 15, 1929.

lilies grew in fair abundance, deer were often seen feeding on them.

The parts generally eaten were the leaves, although the stems were sometimes taken, too; and in order to secure these they would thrust their heads into the water (sometimes completely immersing them), pull up the long stems, eat the more tender parts and discard the remainder. In this selective feeding process they would go over a whole bed, picking out a leaf here or a stem there. It was common in the first two localities mentioned above to see beds of pond lilies with many stems sticking out of the water, from which the pads had been bitten off. In feeding on these plants the animals both waded and swam. When wading they would feed on both stems and leaves, but when swimming they were able only to secure the leaves. By watching, one could easily tell whether a deer was feeding, or just pleasure-swimming, as it were, for although one might not actually see the pad, one could tell when it was being nipped off by the quick backward throw of the animal's head.

The white pond lily (*Castalia odorata*), too, was eaten where it occurred, but it is not very plentiful. An instance was noted in the latter part of August, 1927, at the outlet of Witchhopple Lake, where a doe was feeding on this species of lily.

WILD RED RASPBERRY (*Rubus strigosus*). These canes (Fig. 123) often grow in abundance in the more open parts of the woods and along the shores of ponds, lakes, and streams. Because of its abundance this plant is probably one of those most extensively eaten by deer. As soon as the new shoots appear a few inches above the ground they are nipped off; and deer were seen many times browsing the more tender leaves at the tips of the new canes. In this case we have another good example of the selective browsing of deer. They will tramp through a raspberry patch, leaving plenty of evidence of their activity from the trampled canes, but not much evidence of browsing, for only here and there can a place be found where they have nipped off leaves. As the leaves of the raspberry remain on the stem and stay comparatively green for a much longer time in the fall than do those of most other plants, the deer continue to browse upon them over a considerable period. It was pointed out by residents that even the greener canes were eaten as the winter advanced.

WILD BLACKBERRY (*Rubus villosus*). Although not so abundant generally as the red raspberry, the blackberry where it occurs appears to be sought just as eagerly. Patches were seen where the

tips of the young shoots and most of the leaves had been practically all stripped off, furnishing examples of some of the most extensive croppings happened upon anywhere in the woods. Where this plant grows in patches of considerable extent, deer sometimes return repeatedly to feed until the supply is completely exhausted. Conspicuous examples of this were noted in the latter part of July, 1927, along the Rapshaw Club trail where it passed Salmon and Witch-hopple lakes, near Beaver River. Here the canes in three large patches had been stripped practically bare of their leaves.

WITCH HOBBLE (*Viburnum alnifolium*). Witch hobble is one of the most common shrubs of the forest floor in the Adirondack woods. Anyone who has undertaken a "cross-country" tramp here knows well the large leaves that tenaciously hold the dew and rain, and the stems that are forever tripping one up. The first locality where this plant was actually seen to be eaten by deer was the vicinity of Safford Pond, June 27, 1927; but extensive signs had been noted before that date. The parts eaten were the tips of the season's growth of branches, including the young unfolding leaves and the terminal buds. Other patches showed where the larger leaves had been browsed, leaving only the petioles to witness the fact. Mr. Joe Jenkins, game warden at Thendara, asserts that the larger terminal buds are one of the principal early spring foods of deer, since they are one of the first to develop. This statement is corroborated by the evidence that in some places there remained the short dead branches, indicating that the terminal buds had been removed earlier in the season. Along the east shore of Cold Stream Lake, near Piseco, was found evidence of an old yarding ground, and here all the witch hobble had been nipped off short (and the evergreens, too, had been trimmed). Similar evidence was noted in other yarding places, as at the north end of T-Lake, in some ravines at the top of Outlet Mountain and along the east shore of "L. D." Lake. However, considering the great abundance of witch hobble in the woods, this shrub does not appear to be extensively browsed. It seems to be taken mostly in winter and early spring, and more from necessity than from preference. In late summer no fresh croppings were noted in three seasons of study. And in the Brandreth district no indications were found that deer were feeding on this shrub.

SARSAPARILLA (*Aralia nudicaulis*). Sarsaparilla is common both in the semi-swamp areas and in the drier balsam woods of the regions studied, with the possible exception of the Piseco district where, although the plant occurred, it was not so common. Croppings of

this plant were first noticed in the Big Moose district. Here and at Brandreth, especially, in some localities many of the shoots observed had been cropped. During late June and early July, when the plant is in flower, or just previous to the appearance of the flowers, deer seem to eat it most extensively. As it grows older and tougher it is disregarded. The parts eaten were the leaves, and possibly also the bloom.

ALGAE. Localities where deer were seen to feed on algae were along the Beaver River Flow, around Nehasane Lake at Brandreth, and Cold Stream Lake and Milligan Vly at Piseco. In no other locality were these plants found to occur in any considerable quantity. They are doubtless eaten by deer wherever they occur in their territory. The gradual falling of the water level in the Beaver River Flow left innumerable stagnant pools and backwaters where the conditions for the growth of algae were ideal; and in many instances it was found that the water, as well as stumps or other débris in these pools, was covered with a green mat of these plants, principally *Spirogyra*. It was here that the most extensive growth of this plant was observed. Deer came to feed on it alone, seemingly, all along the Flow; and the largest number of deer seen foraging together at any one time were feeding on this algal species.

That deer actually have a strong preference for this kind of food seems accordingly to be shown by the relatively large number of the animals that come to feed on it where it can be obtained, as well as by the method they adopt to secure it. For example, along the shores of Nehasane Lake, in the latter part of August, 1927, it was noticed that deer were getting food in the shallow water by immersing their heads in the same way as when they are feeding on pond lily stems. Upon investigation no water plants could be found, except little tufts of algae clinging to small sticks or lying in little depressions on the bottom. Therefore the conclusion was forced that this rather scant green algal matter was what they were diligently seeking—to the exclusion of other "deer food" found near at hand and in greater quantities. If this is true of deer at Nehasane Lake it is very likely true also of deer at many other lakes or ponds in the Adirondacks where such "green matter" occurs in proper abundance.

The earliest date on which deer were noted feeding on these algae was June 9, 1928, in Milligan Vly. Here an old doe was seen to pull up strings of mud-covered algae and devour them with apparent relish. Later in the same summer a number of deer

(several does and two bucks) were observed at different times feeding on algae in Cold Stream Lake. As in other instances they secured it by immersing the head completely. Twice it was noted that upon immersing the head, they would take several steps forward. Only a part of the back, in the case of a doe, and a part of the back and tips of the antlers, in the case of a nine-point buck, could be seen while the animals were reaching under the water for the plants.

Although deer usually exhibit a certain daintiness in their feeding habits, this seems to be abandoned to a large extent when they feed on these masses of stringy algae lying in the stagnant pools.

DEER GRASS OR PIPEWORT (*Eriocaulon septangulare*). Deer grass is the local name applied to this plant, which grows in the shallower water around the shores in most lakes and beaver ponds. Deer eat this grass through the summer months, but more especially during June and July than during August when it sends its bloom to the surface. Three does that came into Thirsty Pond, at Big Moose, every evening during the latter part of June and the first of part of July, were then seen to feed entirely on this plant. Some deer in all the localities studied were seen at some time or other to feed on it. They secured it by thrusting their heads under the water and pulling it up; but they rejected a major part of the plant, and it was common to see many of these rejected parts clinging to the laurels along the margins of lakes and ponds. In fact, these floating plants were often the first noted signs that deer were feeding in a certain pond or lake.

BRACKEN (*Pteris aquilina*). Just to what extent deer use this fern for food is a question, but that they eat more or less of it was evident from the fact that it was found cropped in places where the animals had been feeding on other plants. Around Half Moon Pond, near Old Forge, it was noticed in the fore part of June, especially, that a great many of the young bracken shoots were nipped off; but later in the season, at Brandreth, when the leaves were completely unfurled, no browsing on ferns was observed at all. In the Piseco region no croppings of this plant were encountered during either season.

NETTLES (*Laportea canadensis* ?). Only in the Piseco region during the season of 1928 were deer seen to feed on these plants. Here, especially along the first three miles of the Spruce Lake trail (Fig. 124) were extensive beds of nettle growing in the semi-shaded parts of the beech-maple woods. On July 17 it was noticed that a



Fig. 99. Upper Bog Stream, showing grass meadows and clumps of alders.
August 29, 1929.



Fig. 100. Alder thicket along Bog Stream. August 29, 1929.



Fig. 101. Hay meadows near Upper Bog Stream. August 29, 1929.



Fig. 102. Bog Stream. Deer waded into the water from the grassy shores, such as the one on the left, rather than from the dense alder thickets at the right. August 29, 1929.

great number of the plants had been nipped off. Deer tracks were plentiful along the trail and they were also found where the nettles had been cropped, giving clear evidence that deer were responsible for the work. Deer had not been feeding on the plant in this vicinity the week previous. The extent of the browsing increased until by the middle of August, in places, all the plants had been stripped of their upper leaves. This affords another example of extensive croppings in one spot, contrary to the usual browsing habits of the deer.

DECIDUOUS TREES. In the case of chokecherry and other deciduous trees the parts eaten are the tender leaves of the sprouts growing around the stumps of recently cut trees, or of smaller saplings; and in the elderberry the leaves on the new stalks are nipped off. The cropping of chokecherry was first noticed on August 19, at Brandreth, where the shoots around the stumps of several trees lumbered the preceding winter had been cropped; and on the following day similar browsing was noted along the railway track near Brandreth station, where the hoof prints of the deer could be seen in the loose earth around the stumps. Maple occurs more widely and is more extensively eaten, as evidenced by much cropping of the more tender terminal leaves of saplings two or three feet in height. Poplar saplings were found cropped in one locality in the Brandreth region, in the latter part of August. At Piseco on July 9, 1927, a six-point buck was actually observed to feed for some time on poplar leaves. In the case of beech and birch the parts eaten were the tender leaves on the small saplings and seedlings. Such croppings were numerous in all the districts examined, especially during June and July. In only one instance was elderberry (*Sambucus racemosa*) noticed to have been eaten, namely, at the Twin Lakes, June 29, where a large clump of this shrub had been recently stripped of the greater part of its leaves. Elderberry was not noticed growing elsewhere in this neighborhood.

GRASSES. Various kinds of grasses were found to be eaten by deer. This was particularly true earlier in the season when the plants were young. One could then see deer browsing in the more open meadows and around beaver ponds. However, as the season advanced and the grasses became coarser they were not eaten to any noticeable extent. In any case it may be said that grass apparently is not an important item of deer food. Two does commonly fed in the evening and at dawn in the fields of a farm north of Piseco, but it could not be definitely determined whether they were feeding on

the various grasses there found. During the latter part of May, 1928, at Piseco, several such croppings were found at different points; and in one instance several bunches of a sedge, probably *Carex* sp., had been nipped off. Due to the immature condition of the grasses at the time they were found to be cropped most frequently, they could not be specifically identified with any certainty.

GARDEN TRUCK. Deer, as is well known, are fond of various vegetables and other cultivated plants. This fact was evidenced especially at Big Moose Lake, where the few gardens that were being cultivated had high wire fences around them for the express purpose of keeping deer out. However, there is not enough cultivated land for the animals to become such a nuisance in this section of the Adirondacks, at least, as they are reported to be, for example, in Pennsylvania, where the farmers are complaining of deer raids on their fields. (Biennial Report of Game Comm'rs. of Penn., 1925-26, p. 43.) But depredations occur at times, and Mr. Pete Walters, fire observer on Moose River Mountain near Thendara, told of an experience he had during the summer of 1926, with a bed of China asters that he had reared at considerable expense, effort and patience. One afternoon, on looking down from the tower, he saw a doe calmly nipping off the buds of his highly prized asters, which were then just beginning to open. He hurried down and chased the animal away before very much damage had been done, but it came back sometime during the following night and completed the destruction.

ROOTS. Evidence of the deer's appetite for roots was frequently noted in the woods in the Piseco region. In the summer of 1927 the majority of such grubbing spots were found in spruce and hemlock woods (Figs. 125 and 126). The following summer they were found also in mixed woods, but usually in close proximity to some evergreens. In 1927 a number of spots was noted in a spruce grove about a quarter of a mile west of T-Lake, along the outlet. At different points spots about ten or twelve inches in diameter had been rooted up; and at one place a deeper rounded hollow showed the impression of the deer's nose where it had been thrust into the soft earth. Frequently one or two tracks could be discerned in the loose earth, and droppings were found near by. Such spots were also found on the eastern shore of T-Lake, and a few on the western shore; in each case there were spruce trees close by. In 1928, besides a number of smaller spots two more extensive ones were found. On June 8 a doe was started on the Cold Stream Lake trail. It was found that it had been grubbing on a little hummock

and had torn up a patch of earth about three feet by two. The trees listed as growing in the immediate vicinity were hemlock, spruce, soft maple, yellow birch and shrubs of moosewood and witch hobble. The principal herbaceous plant round about was *Oxalis*. Again, on July 23, on the east shore of T-Lake, were found two such spots, about two feet square, within eight feet of each other. Within ten feet of these grew spruce, yellow birch and witch hobble, ferns and *Oxalis*.

On July 11 a doe was seen grubbing on the west shore of T-Lake. Once it spent ten minutes at one spot and during this time did not move out of its tracks, but frequently lifted its head and looked around in the usual manner of wild deer. In grubbing, it would seem, the animals use the muzzle and the teeth for the most part, rather than the hoofs.

STUMP CHEWING. Deer frequently chew at old stumps. Their work here is often hard to distinguish from that of the bear, which tears these old stumps apart mainly to secure the ants found in them. Figure 131 shows such a bear stump. A bear usually tears the stumps into larger pieces whereas a deer chews at exposed corners and leaves a different mark. It seems likely that deer do not chew stumps which have been recently nosed over by a bear. If the work is that of a bear one can usually find some faint trace of its teeth on the soft wood splinters and débris, occasionally its claw marks on the larger pieces and now and then its excrement in the immediate vicinity. If deer have been at work (Fig. 130) their sharp hoof marks usually can be found in the earth beside the stump, and sometimes dung pellets occur.

Other old logs as well as stumps frequently were found torn apart by deer (Fig. 132) in all the localities studied, but especially on the west slope of T-Lake Mountain and around the shores of Lizard Lake, west of T-Lake. At these two points numerous such stumps and logs were found within a relatively small area. Just why a deer chews at a stump of rotten wood is hard to determine unless it derives from this source a certain amount of mineral matter. In the case of decayed logs they are possibly able to secure roots which have penetrated the soft wood. These logs are comparatively easy to tear apart. In this connection Newsom ('26) mentions the fact that deer sometimes go into a burnt-over area soon after the fire, and perhaps the ashes attract them in somewhat the same way as a salt lick.

SALT. As is well known, deer are fond of salt. There were

apparently no natural salt licks in the districts investigated; in fact very few are said to be found in the Adirondack woods. Colvin ('74) reports a deposit of marly clay where the deer licked and possibly obtained a trifle of potash, alumina and iron. Near settlements salt licks may perhaps have been formed accidentally in some instances, through spilling of salt, but many people make a practice of putting salt on stumps in their vicinity to attract the deer, purely for æsthetic reasons. This practice is sometimes also illegally resorted to for the purpose of attracting deer into position for an easy shot. Wherever salt is put out in this way the deer soon have the stump licked and scraped smooth. The ground about is often packed hard as the result of continual stamping of hoofs.

Near the T-Lake fire lookout a salt bag some time previously had been placed upon an old stump (Fig. 133), and deer had become frequent visitors. The stump was now found chewed down to the roots, and the surrounding earth marked by innumerable hoofs. Mr. Nye, of the lookout station, remarked that if a generous quantity of salt is placed at a lick individual deer will come to the spot only about once a week, whereas if only a small amount is put out they are likely to come night after night. He also pointed out a spot where a porcupine had gnawed at one of the logs by the old salt lick, and said that after a porcupine has visited such a place, deer would not return for several days. He thought they were wary of the quills which are dropped here and there. However, it seems more probable that it is the odor of the porcupine that keeps the deer away. At the keeper's place at Keepawa, in Nehasane Park, there was a large salt-stump (Fig. 134) which deer visited at various times of the day, but especially towards evening. Another salt lick was noted at Ten-Mile Mark, near Little Tupper Lake.

Winter food. With winter comes a scarcity of food for the white-tail; not necessarily so much in quantity, perhaps, as in variety, although in deep snow the quantity that they are able to reach may also be reduced. In the districts where this study was carried on the menu was reduced chiefly to twigs of deciduous trees and evergreens. A favorite haunt of the deer in the fall before any great depth of snow has fallen is a beech flat, for mast of any kind is eagerly sought after. The ground under the beech trees will often be found torn up through the efforts of the deer to secure the sweet nuts hidden among the leaves and other débris on the forest floor.

As the snow becomes deeper, and the food on the ground therefore inaccessible, the deer resort to the smaller twigs of such trees as



Fig. 103. Grassy shore along Bog Stream showing runways leading into water. August 29, 1929.



Fig. 104. Northern shore of Stony Pond. Deer wading at edge of water, left center. July 15, 1929.



Fig. 105. Slim Pond. Steep rocky shores, a relatively poor feeding ground for deer. July 30, 1929.



Fig. 106. West Shore of Robinson Pond. A favorite feeding ground for deer in July. August 20, 1929.

birch, beech and maple, and such shrubs as witch hobble and moosewood; also such evergreens as balsam, hemlock, spruce and cedar. Pine apparently has an ill effect on them and is avoided. Dr. Charles E. Johnson, of the New York State College of Forestry, is of the opinion, following investigation, that the major portion of the winter food consists of buds and terminal twigs of deciduous species rather than of evergreens, contrary to what most of the residents of the districts included in this study believe. He argues very logically that wherever deer feed on evergreens the evidence is plainly seen, but not so with the cropping of twigs of deciduous species. Further, if the greater amount of feeding was on the evergreens there would be much more evidence of it than actually is found. To corroborate this a doe shot by mistake in the fall of 1927 at Piseco on examination was reported to have had a stomach full of recently cropped twigs of deciduous trees. On the other hand, different places were found where the balsam had been trimmed by deer (as in one case that was measured) to a height of nine feet five or six inches. Of course such high trimming must depend upon the depth of compact, drifted snow at the time, firm enough to support the weight of the deer, for this height is otherwise far beyond their reach.

Food as the chief factor governing local activity and migrations. Food is of course an important factor in determining the activity of deer. Much of their daily routine consists of going to and from the feeding grounds. Where a certain type of shrub or other food plant is abundant and in its most palatable condition deer will resort each day to feed. A week or so later when this plant has disappeared or has become old and tough, perhaps, the animals seek elsewhere.

In the late spring the animals are scattered throughout the woods, as would be expected at a time when a wide variety of succulent food plants is available. When June comes they begin to frequent the lake shores and the beaver ponds where deer grass occurs and is now at its best. Pond lilies, too, are now beginning to appear at the surface of the water, while in the open stretches various tender grasses are to be found. In late August—but depending to some extent on the season—the majority of the deer again scatter through the woods. The lily pads have grown tough and the deer grass—and other kinds—which is now sending its flowers to the surface of the water, is no longer tender. But there are places where algae at this season grow in abundance; and in the woods are plenty of desirable weeds and shrubs, as, for example, nettles and red and black

raspberries. In the fall, according to most authors, beechnuts may attract them to the beech flats and slopes. In the winter the snow, if deep, prevents free choice and the deer are compelled to eat what is available. It is clear, therefore, that food is a main factor in determining the seasonal habits of these animals.

The set-back along the outlet of Falls Lake, west of Brandreth, was the locality in which the greatest numbers of deer were seen, at any one time, during the season of 1927. As mentioned previously, twenty-four were seen here on one afternoon, feeding on algae within a space of about thirty acres. By the middle of August only two or three individuals were still to be seen feeding at this place. The reason was simply that the water level had fallen to such an extent that the pools had dried up and the algae had largely disappeared. This shows rather clearly how the feeding habits of the deer may sometimes be modified by the nearness and the abundance of the food. Along the Beaver River Flow, also, the number of deer frequenting a certain set-back apparently fluctuated with the water level which determined the amount of algae available. Algae are, therefore, as in this case, sometimes an important item in the diet of deer.

The correlation between the condition of a feeding ground and the numbers of deer frequenting it was also well illustrated at the mouth of the north branch of Beaver River. When this locality was examined first, in the middle of July, the water was comparatively high, deer signs were scarce and few of the animals were seen. However, in about two weeks the water level had fallen and there were left many small pools in which algae were growing profusely. Deer signs now become plentiful and a larger number of deer were seen. Then, near the end of August, the pools had dried up, the algae had died, and as a result only a few deer were again to be seen here.

Algal food likewise seemingly was responsible for the numbers of deer feeding in Cold Stream Lake, near Piseco, in the season of 1928. Observations were made on this lake at different intervals and at different hours of the day, but not until July 24 were more than one or two deer seen in this locality at one visit. On this date seven does were seen at 2:00 p. m. From this time on until we left the locality on August 18, this lake was the most favorable one at which to observe deer. Earlier in the summer, because of rain, the water levels were high, but later fell, and at the time when deer were seen feeding in largest numbers, quantities of algae were grow-

ing in the shallower water. The deer were eating this green stuff and it is safe to suppose that they now began frequenting this locality because of the increased food supply. Earlier in the summer a number of deer were seen around White Birch Lake, three-quarters of a mile west of Cold Stream Lake, but when the largest counts were made at the latter lake, only one or two deer—and more frequently none—were to be seen at the former. The supposition is that the deer from the White Birch neighborhood changed their feeding grounds to Cold Stream Lake. No positive conclusion can be drawn on this point, but it is without question that deer did come to this lake to feed, from some other section, at the season when the algae increased in quantity.

As food is the main factor determining the activity of deer in summer so it is in winter. Without doubt food is, probably, a major factor in the selection of the yarding grounds, although another important factor may be that of shelter. One yarding ground observed at the north end of T-Lake, in the Piseco region, was very favorable from the point of view of food. Here were a series of flat, swampy terraces covered with many saplings; and plenty of witch hobble and moosewood—all deciduous species, the smaller twigs of which are eaten by deer in winter—intermixed with a few small spruces.

Mr. Stanyon, game warden in the Piseco district, said that a large number of deer usually winter along the west branch of Sacandaga River, at different points, and that they “migrate” into this valley from the surrounding woods. He maintained that the chief factor in determining this “migration” is the presence of balsam, which at certain points indeed shows evidence of many years of cropping by deer. But shelter may also be a large factor in determining this behavior. Actual winter observations are needed to reach any reliable conclusions on this point.

SCATOLOGY

In summer the signs of deer that are easiest to find on the leaf-covered forest floor are perhaps the little heaps of dung pellets. These may be found in a variety of situations and in places where the animals leave no readily noticeable tracks on the ground. Deer manure varies a good deal in form at different times and under different food conditions. When fresh it consists usually of clusters of small pellets more or less stuck together in one mass, but which occasionally remain separate. For the adult deer a typical pellet is

about three-quarters of an inch in long diameter, half an inch in short-diameter, and somewhat cylindrical; but there is considerable variation both in shape and in size of individual pellets. Fresh pellets are blackish and glistening, and soft interiorly. Individual pellets of deer (Figs. 135 and 136) are at times not easily distinguishable from those of some of the other mammals in the region, like the porcupine and the snowshoe rabbit. In the latter two, the pellets are, however, of a more fibrous, woody texture. Porcupine pellets are somewhat cylindrical and may be as long as an inch and a quarter, while rabbit pellets are smaller and circular or disk-shaped. Figure 137 shows the general characteristics of porcupine droppings.

POPULATION STUDIES

General data. The region about Old Forge was not particularly favorable for the study of deer activities, and it was necessary to get back a considerable distance into the woods before signs of the animals were at all plentiful. This is speaking in general terms of this locality, for it is true that deer habitually came down to Nicks Lake to feed, and this was only a little over a mile from Old Forge. However, it is quite natural not to find deer where they would be continually subject to disturbance, as would be the case if they remained in very close proximity to Old Forge. This village is one of the largest in that part of the Adirondacks. The fact that it was necessary to go so far back into the woods, deprived us of at least one of the two most favorable periods of the day for seeing deer. And even at a considerable distance from the village one frequently met with parties of visiting fishermen, whose comings and goings apparently were sufficient to keep the deer from venturing abroad to feed during the hours of daylight. Promising lakes and streams thus would show indications that deer were in the neighborhood, but to see them was very difficult. But it appeared, too, that there were not so many deer in the Old Forge district as in the other districts examined.

The Twitchell Lake district at Big Moose was also much frequented by fishermen and summer visitors. Comparatively few deer were, likewise, seen in that vicinity and signs were rather infrequent. However, there were two localities in this district which proved to be favorable for study, namely, the territory around the head of Big Moose Lake and that along the Raquette trail. Deer were plentiful in the Gull Pond and Andes Creek areas, north of Big Moose Lake Inlet, as well as a short distance more to the northeast of Big Moose



Fig. 107. South shore of Little Flatfish Pond. August 19, 1929.



Fig. 108. North shore of Little Flatfish Pond. August 19, 1929.



Fig. 109. Doe at water's edge. Big Flatfish Pond.



Fig. 110. South end of Antedeluvian Pond with low shore.

Lake. Summer visitors to these localities were relatively few and consequently the deer encountered but little disturbance from that source. The greater activity of the deer during the day here indicated that they were not being much disturbed at their favorite feeding grounds. As high as ten deer were counted around the Upper Sister Lake, on June 29, 1927, at 3:30 p. m.; and this was by no means the total number that came down to the water between noon and sundown.

In the locality of the Raquette trail, which includes Constable Pond and Pigeon Lake, deer were also frequently seen and signs of their activity were abundant.

In the Brandreth region we saw the greatest number of deer. Here the major part of the land is privately owned, comprising Nehasane Park and the Brandreth Tract. As to the most favorable places to study deer in this vicinity there was not much choice, since the animals could be seen commonly about almost any of the lakes in the territory. Some set-backs along the Beaver River Flow and Nehasane Lake furnished opportunities for us to keep a considerable number of deer under observation. One or two lakes, such as Rock Lake, were found to be seldom frequented by deer, evidently because of rocky shore-lines along which food was scarce.

At Piseco it was hard to find localities undisturbed by people. The T-Lake neighborhood was our principal area of study, and the greater number of deer were seen here, although as the season advanced the parties of summer hikers made it rather useless for further observations, except to note how the deer reacted to increased disturbance. White Birch and Cold Stream lakes were in more remote sections and were good localities for seeing deer as well as signs of their activity; especially was this true of the latter lake in mid-summer of 1928. "L. D." Lake, southwest of T-Lake, was said locally to be one of the best localities for deer in the region, and similar reports were received with regard to Spruce Lake, twelve miles north of Piseco, and Clockmill Pond, eight miles to the south; but our time permitted only a mere cursory examination of the first mentioned of these three localities.

The region of Little Tupper Lake was relatively undisturbed and well protected by the caretakers on the Whitney Park. The most favorable localities for observing deer, and where they were most abundant, were: Sperry Pond, Bog Stream, "The Slang", Camp Bliss and Flatfish Ponds. Some of these localities are not included in the ten-square-mile area the population of which is discussed below.

Deer populations. An attempt was made during the three seasons of observations to estimate the number of deer per square mile in various areas. Such an attempt presents numerous difficulties and at best can be made only after one has become thoroughly familiar with a given area. However, certain methods were used which might be repeated in various other sections, with, perhaps, a reasonable approach to accuracy.

As before mentioned, the field work consisted largely of making repeated trips to various observation points in a given locality, always proceeding as quietly as possible, taking notes, and making a record of all deer seen or heard from these observation points or on and along the trails. At the close of the season the areas most thoroughly examined were circumscribed on the topographic sheets, the number of deer estimated for each locality within each area, based on our field records, and from the totals thus derived estimates were made of the number of deer per square mile for the area in question.

Table No. 2 gives a summary of the results of such compilation for three seasons. At Piseco the area studied was rather small, comprising about 10 square miles of territory lying at least three miles back from the State roads and settlements. Here the deer population was estimated as 7 per square mile.

In the Old Forge region a more hasty study was made during the early part of the season of 1927. An area of about 60 square miles is included in the circumscribed area on the map. This large area centers around the settled communities of Old Forge and Thendara, and, as might be expected, the population of deer is relatively very small. Our estimate for this entire area is only one deer for every six square miles.

At Big Moose we covered an area of about 40 square miles including Big Moose settlement and the area of Big Moose Lake. The study was made during a period of three weeks in July. The result was an estimate of one deer per square mile.

Near Brandreth, during a period of six weeks in the late summer of 1927, what we believe to be a closer estimate of deer population was made. Here an area of about $31\frac{1}{2}$ square miles was studied more intensively, and the number of deer per square mile over this territory, including the lake surfaces, is estimated at about five per square mile. Two localities in this region were given more attention than the others, namely, those of Nehasane Lake and Falls Lake. Along the shores of Nehasane Lake the junior author saw as many as 23 deer in one afternoon, and since this part of the day is not

generally the most favorable one to see deer, that number might doubtless be doubled and still represent a conservative estimate of the deer feeding around the lake. Taking 50 as the number of deer in that vicinity, an area roughly estimated at seven square miles, we have an average number of seven deer per square mile.

A denser deer population was found in the locality of Falls Lake. Along the outlet stream as many as 24 head were observed at one time; and since these were seen at a time of day when the majority of the animals are usually feeding, doubtless a large proportion of the population was here represented. Therefore an estimate of the total number of deer in that district, an area of about three square miles, may with reasonable safety be put at 35, or about 12 to the square mile.

By averaging the numbers given above for the two localities the result is an approximation of nine deer to the square mile. It must be repeated, however, that the localities under consideration were the most favorable ones in the Brandreth region for the purpose of seeing deer in numbers.

In the territory of Little Tupper Lake, in 1920, the senior author made a similar estimate of the deer population in an area of twenty square miles, as indicated on map 6. It will be noted that this area includes considerable water surface, and it may be remarked also that some of the best "deer country" of this general region lies outside the boundaries of the area of population study. It was assumed that the water surface occupies four square miles of the area. Following the same method already explained we arrived at an estimate of 118 deer for the sixteen square miles of land surface, or roughly seven to the square mile.

But some general remarks may be made here. Estimates of deer population are naturally subject to error because not all the deer in a locality will be seen, and some will be seen several times on the same or on different occasions. As to the bucks one can be fairly sure whether he has seen the same animal before or not, by making careful note of the pattern and size of the antlers; but as to the does it is much less certain. In the course of one day's observations one may be able to distinguish different does by their shade of color or differences in size, but these criteria are rather questionable at best.

The difficulty in making a true count is well illustrated by observations at Sperry Pond near Little Tupper Lake, not included in the area estimated. On August 3, 1920, one of the authors visited this pond, arriving about nine o'clock. Within ten or fifteen minutes he

had seen nine deer at different points, which made it unlikely that the same animal was counted twice. Before 12:30 p. m., when it began to rain, what were considered to be at least 15 different animals had been counted. Three days later the pond was visited again, but now only three deer were seen. The weather was similar to that on the previous visit, except for the direction of wind and the fact that it rained harder in the afternoon. Thus while no doubt there were 15 deer near the pond, one might easily have made a wholly misleading estimate by visiting the locality on the wrong day. Weather, season, food supply, etc., all have to be taken into account in making an estimate of the deer population based on the number of animals actually recorded.

With regard to the area represented by map 6, it may be said that this territory was traversed several times at various parts of the summer between July first and September first. The shores of Bog Stream, "The Slang" and Little Tupper Lake were scanned from a boat, all the roads indicated on the map were traveled several times at different hours, and practically all the territory indicated was crossed and recrossed through the brush and woods at various times. Notes were kept of all deer seen, and as to whether they were bucks, does, yearlings or fawns; and also deer heard in the woods were recorded even though the animals were not actually seen. With this record as a basis the attempt was then made to estimate the deer population with a reasonable approach to accuracy.

Table 1 gives the result of the numerical count. It seems likely that the numbers given are low rather than high, but it is our belief that the average observer is more likely to overestimate the numbers and not make sufficient allowance for the possibility of seeing the same deer time after time at the same place.

Ratio of bucks to docs. In Table No. 2 sex and age data on the animals during the three seasons' work are also included. Analysis of these data is of interest:

In the Piseco region, in the 1928 season, our record of deer of known sex shows 31 does to 17 bucks, or a ratio of about 2 to 1. At Old Forge, in 1927, no bucks were seen. At Big Moose, 35 does were identified to 5 bucks, giving a ratio of 7 to 1 in this much hunted region. At Brandreth the count showed 101 does to 22 bucks, or a 4.5 to 1 ratio. In 1929, at Little Tupper Lake, the senior author obtained a count of 45 does to 26 bucks, or about 2 to 1.

These varying results are a bit hard to explain, but it seems likely that the method of study was in part responsible. At Big Moose

TABLE NO. 1. SHOWING ESTIMATED NUMBERS OF DEER IN SELECTED LOCALITIES NEAR LITTLE TUPPER LAKE IN SUMMER OF 1929.

(See in this connection Map 6.)

Locality	Bucks	Does	Yearlings	Fawns	Undetermined	Total
"The Slang".....	4	6	6	.....	.....	16
*Bog Stream Valley.....	3	2	.....	.....	7	12
Near Ten-Mile Mark.....	4	7	2	1	5	19
Buck Mountain.....	1	3	.....	4	4	12
Moonshine and Cat ponds...	1	5	1	1	1	9
Lower Cat and Grouse ponds. ....	.....	3	2	.....	.....	5
West end of Slim Pond.....	1	2	.....	.....	.....	3
Robinson Pond.....	3	2	2	.....	3	10
Stony Pond.....	2	3	1	.....	2	8
East shore of Little Tupper Lake.....	3	7	.....	.....	4	14
Two Island Bay and Otter Pond outlet.....	4	5	.....	1	.....	10
	26	45	17	7	26	118

Total number of deer estimated in the area of 16 square miles: 118; or roughly 7 per square mile.

* Deer seen in Bog Stream Valley should perhaps be averaged with those seen near Ten-Mile Mark.

TABLE NO. 2. SHOWING CLASSIFICATION OF DEER SEEN IN THE FIELD IN DIFFERENT AREAS.

	Piseco 1927*	Piseco 1928	Old Forge 1927	Big Moose 1927	Brand-reth 1927	Tupper Lake 1929
Does with one fawn.....	1	1	1	2	15	45
Does with two fawns.....	.....	2	.....	.....	2	
Does which probably had fawns hidden in the woods.	3	6	2	14	26	
Yearling does.....	2	9	3	10	34	
Does which were probably barren or had lost fawns..	7	13	3	9	24	26
Young bucks.....	1	4	.....	3	11	
Older bucks.....	10	13	.....	2	11	
Yearlings.....	.....	.....	.....	.....	.....
Deer of doubtful sex determination.....	12	5	1	2	8	26
Does of uncertain classification.....	2	11	.....	2	7	
Fawns.....	1	5	1	2	19	7
Totals.....	39	69	11	46	157	118
Approximate area covered in square miles.....	.....	10	60	40	31.5	17
Estimated population per square mile.....	.....	7	1 1/6	1	5 to 12	7

* The observations at Piseco in 1927 are hardly comparable with the rest, due to the more restricted area worked over. They are based on numbers seen almost entirely along the T-Lake trail, at T-Lake itself and in the pasture north of Piseco village.

and Brandreth early morning fogs made it difficult to make observations at this time, and our higher number of does may be due to more mid-day observations. Experience at Piseco indicated that the does remain at the lake shores to a later hour than do the bucks, which are inclined to feed early and then go back into the brush. A buck does not, very probably, require so much food as does a doe that is nursing a fawn or two, and accordingly may not be seen on the feeding grounds so long or so frequently. Where more or less disturbance occurs, due to human activity, the bucks are likely to be more retiring than the does. This may perhaps account for the relatively smaller number of bucks seen near Brandreth, for example, where considerable time was spent in observation during mid-day. However, on one occasion, near the set-back along the outlet to Falls Lake in this section, we obtained an observation which may give an indication of the sex ratio of the deer in that area. Here, on July 18, at 6:00 p. m., twenty-four deer were seen feeding at one time, and among these were 5 bucks. This makes the ratio of does to bucks approximately 5 to 1.

Averaging the observations for the three summers, we find a total of 211 identified does to 81 bucks, or approximately a ratio of 2.5 to 1.

Ratio of "barren does" to does with fawns. The question of the ratio of "barren" does, so-called, to those with fawns (either by their side or hidden in the woods) is a highly uncertain one, for obvious reasons, and it is necessary to explain that the term barren as here employed, means only that the doe when observed was not accompanied by a fawn, or fawns, or that its sleek and fat condition indicated that it was not a nursing animal. It is of course often quite impossible under field conditions to distinguish with certainty between "dry" does and does that have fawns, when fawns are not actually seen in the company of the mother. The condition of flesh and of coat of the doe sometimes affords a fairly dependable criterion, perhaps, but it was noticed on three or four occasions particularly that does with fawns by their sides were in surprisingly good condition. One instance especially notable was that of a doe with two fawns, which came out to feed rather regularly along the flow opposite the camp at Little Rapids, near Brandreth. This doe, although nursing two fawns, was very sleek, and if it had been seen alone would certainly have been recorded as a "barren" doe. It was rarely possible, even with the binoculars, to observe the condition of the udder.



Fig. 111. Sweet gale flats along "The Slang." Deer waded and swam to the lily pads, in July. They also fed on the low vegetation beneath the bushes shown in foreground. July 20, 1929.



Fig. 112. A close view of a rubbing tree, showing the bark torn off in shreds which hang downward, indicating perhaps that the animal rubbed with a downward movement.

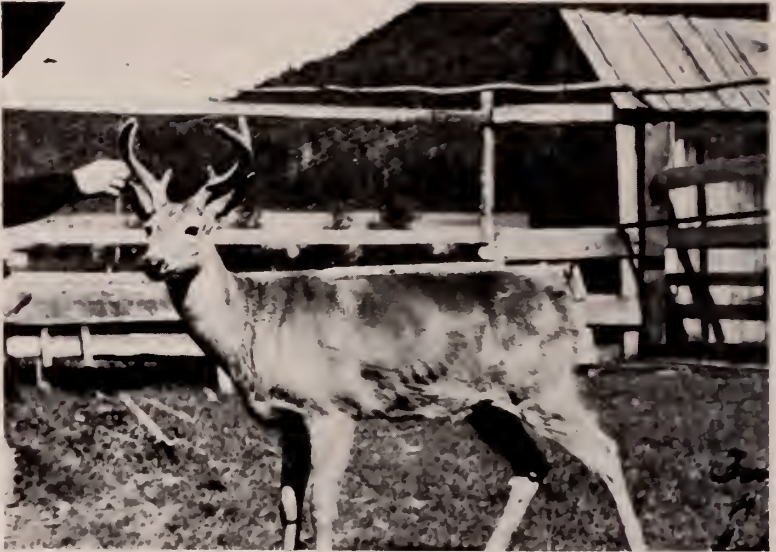


Fig. 113. A tame deer owned by H. Rogers of Lake Pleasant, showing growth of antlers before the animal was castrated. Photograph by H. Rogers.



Fig. 114. Another view of the same deer, in a different year. Photograph by H. Rogers.

The ratio as noted during 1927 and 1928 was 75 does with fawns to 56 does that were considered "barren". This would seem to indicate that a relatively large number of does are not producing young. However, as pointed out above, the actual number of "barren" does might be considerably smaller if the true conditions were known. Still it is entirely possible that many does are not reproducing from year to year. Of course, does in their second summer are not to be considered of fawn-bearing age; but this fact undoubtedly is overlooked in some instances where "large numbers of barren does" are reported.

Yearling does. In our counts there is a relatively large number of yearling does listed: 58 yearlings to 131 mature does (this excludes does of uncertain classification) or a ratio of about 1 to 2. But of course the same uncertainty enters here as in the case of "barren" does. While the smaller females that were in sleek condition were recorded as yearlings, under field conditions it is obviously not possible always to be certain in this matter of relative size; opportunities for comparison of the animals are rarely presented.

The foregoing explanation may possibly account for the apparently large number of yearling does in this particular instance. But generally speaking there is the plausible explanation that the character of the winter may directly affect the number of yearlings. In a severe winter the mortality among fawns of the year would presumably be greater than among the older animals. The winter of 1926-1927, for example, was said to have been comparatively open; a winter when the fawns had a better chance than usual of surviving. But whether the mortality among deer, especially the younger, during hard winters is actually so great as many of the residents would have one believe remains to be proved.

In certain sections of the Adirondacks deer appear, at least, to be somewhat smaller than in others. If this is anything more than an optical illusion then some adult females may have been mistaken for yearling does, and reversely. The reason for this small size is not known, but one resident expressed the opinion that inbreeding on the private parks was responsible for it. It is true that there appeared to be a greater number of smaller deer (that we listed as yearlings) in the Brandreth area than elsewhere; but fundamentally the argument is wrong. Inbreeding has been going on among the deer, as with many other animals, at all times, yet it has had no definitely proven size-reducing effect. It was further claimed by this resident that the deer on the outskirts of the mountains were of a

larger size. There may be, possibly, some element of truth in this matter of size, which further research may disclose.

Does with fawns. Does with only one fawn by their side was the rule most commonly observed. Only four does with twin fawns were seen during the course of this study. Seemingly then, one fawn is the more common number of offspring for each doe. A point to be considered, however, is that the doe that produces two fawns is older, more sagacious and less prone to bring her young fawns to the exposed feeding grounds.

The habit of does of hiding their fawns, that is, leaving them behind somewhere in the woods while they go to their feeding ground, is well known, and it has been indicated above that a considerable number of does were listed as having fawns somewhere in the vicinity. The duration of this hiding period apparently varies more or less with different individuals. In some instances, the fawn begins to accompany the mother after the first two or three weeks; in others, it seems to remain in seclusion for a greater part of the summer. For example, a certain doe came under our observation that fed habitually in a set-back of the flow grounds only a couple of hundred yards from Brandreth station. When we first saw this animal, we listed it as a doe that had a fawn hidden somewhere. But not until August 23 did we see this fawn come out to the feeding ground with its mother and it was then well grown. Again there was the doe which was frequently seen along the flow grounds opposite the camp at Little Rapids. In this case there were two fawns, and they did not appear until the latter part of July, being then quite large.

On the other hand, a doe and her fawn were seen on June 20, feeding along a beaver pond on the stream between Blackfoot and Little Simon ponds, at Old Forge. The fawn apparently was not over a few days old, yet the mother allowed it to follow her to the feeding grounds. Again, on June 24, a doe with a very small fawn was foraging along the shore of Little Independence Pond at Big Moose.

It would seem, therefore, that there is considerable irregularity with regard to the age at which fawns may begin to follow their mothers to the feeding grounds. But possibly in many instances the young are in the immediate vicinity and merely do not come out into the open where they can be seen by the observer. It may be, however, that nearness of human habitations or activities is a factor influencing the behavior of the animals in this connection. In the



Fig. 115. The tame deer a few seasons after castration, showing the freak antlers which developed after the operation.



Fig. 116. Another view of castrated tame deer to show the freak stub antlers.



Fig. 117. A beaver pond on Indian Brook, near Old Forge. This and other such ponds were favorite foraging places for deer. The land adjoining is an old burn. June 17, 1927.



Fig. 118. A close-up view along the shore line of Beaver River Flow proper. The doe is feeding on raspberry. The fawn is one of twins. August 3, 1927.



Fig. 119. A view taken a minute after that of figure 118. The doe moved away at the click of the camera, but the fawn remained and even came closer after its picture was taken. August 3, 1927.

two cases just mentioned, where the fawns were in seclusion for the greater length of time, the proximity of man and his disturbing influence may definitely have been a factor. In the other two instances, however, especially at Little Independence Pond, there was little or no disturbance from such a source.

It was noticed that when a doe had her fawn with her she was more nervous, more alert, and her stay on the feeding ground shorter than when alone. It would, consequently, seem to be an advantage to the mother during her feeding periods to have her young safely hidden in the woods.

Bucks. The numbers of young and of older bucks were practically equal, in the Big Moose and Brandreth sections, whereas at Piseco two seasons of observations indicated that older bucks outnumbered young ones about 5 to 1. Bucks with spikes or forked antlers were recorded as young, while those with a greater number of points were listed as older. The majority of these older deer had from six to eight points, and from this fact it may be concluded that they were all not less than three or four years of age. It is known, however, that a deer does not grow any regular number of points each year but that the number depends upon the vitality of the individual or other factors. For example, a buck in the third year may develop only one additional point or he may add two or three. Nevertheless, in general it would be correct, probably, to say that the average age of bucks with six to eight points is at least three or four years. Two bucks with ten points each were seen, and one with twelve. These may be considered as several years old. It might be mentioned that the number of points is not always a true indication of the size of the antlers, for different deer with the same number of points will show considerable differences in both size and spread of their antlers.

It is not surprising that few animals of a more advanced age were seen. Hunting, especially, tends, doubtless, to keep the number of such animals actually small. If a large buck with a fine set of antlers is known or reported to range in a certain locality, some hunters will be particularly eager to get this individual and will spend a greater part of the hunting season in pursuit of him. If, moreover, such a buck is found very close to a village or a camp his chances of surviving a hunting season are hardly worth mentioning.

Comparative numbers now and formerly. It is probable that the numbers of deer in New York State, have, in the aggregate, because of restrictions of range, decreased to a marked degree within the last century. However, the white-tail is one of the few larger

animals able to maintain themselves successfully in rather close proximity to human activity, if given a fair chance. From the testimony of residents in different sections of the Adirondacks, the decrease here during the last twelve or fifteen years has not been so marked as might be supposed considering the increasing hazards of their existence. This, as pointed out elsewhere, is probably due in a large measure to the greater safety offered by many private parks of the region as breeding grounds, and to the comparative inaccessibility, to man, of much other territory in the Adirondacks generally.

While resident opinion as to the decrease or increase of deer varied greatly, this might be accounted for in large part by difference in locality. Old residents at Old Forge spoke of a big decrease in deer population in that section of the Adirondacks; which is not surprising, for in the last few years this territory has been exploited very heavily. However, these older men now no longer go into the woods, themselves, and their explanations of the conditions now prevailing are consequently based on second-hand information. Mr. Joe Jenkins, game warden at Thendara, painted a less gloomy picture, although he admitted the number of deer in the more immediate neighborhood of Old Forge was on the decline. But he declared that a little farther back from the settled section the deer population had not decreased appreciably in the last ten years.

At Big Moose and at Brandreth the opinion of the residents was that the deer in these areas were holding their own—for the time being at least. There is an alleged fluctuation in numbers from year to year which residents attributed to the character of the winters. That such fluctuation does occur may not be doubted, but that the winter conditions are the cause is an assertion that cannot so easily be proven. As will be mentioned again, deer mortality from starvation is evidently exaggerated by many people. Private parks still have an abundance of deer; by this is meant that there has been no appreciable variation in the number of deer in these parks in the last fifteen years.

From opinions expressed by residents it is hardly safe to draw any conclusions with regard to the status of the deer herd. It may be said, however, that in the majority of cases residents interviewed were quite optimistic because of the manner in which the deer population seemed to be maintaining itself in their respective localities. But considering the various districts in their entirety, a gradual decrease of deer seems to have taken place, although in no instance striking or alarming; on the other hand, decrease in some parts seems to have been balanced by increase in other parts.

MORTALITY

Accidents and disease. Death from accident takes a certain toll from the deer population. Individuals will sometimes in winter, according to reports, make their way to the edge of a stream or lake, where open holes occur, in an endeavor to get water, but are unable to get back again over the wall of snow often bordering the water courses at this season. Thus trapped, they are said sometimes to die from starvation, or perish by falling into the water holes.

Snagging is another cause of accidental death. Seton ('27, pp. 280-290) lists several cases of snagging, some of which had fatal results, others not. Such accidents probably do not happen often. Only one or two people interviewed in 1927-1928 had known of casualties of this type.

Deer are occasionally killed at night by fast driven automobiles (see Fig. 140). Similarly the modern locomotive is occasionally responsible. On June 28, 1927, a doe and her fawn were found dead along the railway track south of Big Moose. They had been killed the previous night for the bodies were not there at 5:00 p. m. the day before. Three deer were also killed along the tracks near Brandreth, during the six weeks we spent there in 1927. Accidents of this sort occur more commonly in winter, when deer take to the road-bed as an easy highway of travel. According to the station-master at Brandreth, between Brandreth and Partlow stations, a distance of two and a half miles, seventeen deer were killed by trains during the winter of 1926-1927. Eleven of these were killed near Partlow station. They were attracted here by hay and oats that had been unloaded and stored in open sheds for a neighboring lumber camp. The deer made nightly visits to these sheds, and had a well beaten trail across the railway at the point where most of them were killed.

Deer were reported also to plunge over T-Lake Falls near Piseco. Here the water of the outlet stream of T-Lake falls over a vertical cliff three hundred or more feet in height. In winter the rock bed of the brink would be icy and it is very likely that a deer attempting to cross here would fall, and might in its struggle to rise, plunge over the sloping ledge, but this probably happens only seldom and the number of deer that are said to go over is probably an exaggeration. Only one person was met with who had actually seen a deer that had perished in the manner stated.

Mortality due to disease is thought to occur principally during

severe winters. Scarcity of food, or inability to secure food, during periods of deep snow and severe cold, doubtless weakens the animals so that towards spring (March, especially), when the critical season arrives, a certain number succumb to disease. Apparently in many cases death results directly from pneumonia. Mr. Joe Jenkins, game warden at Thendara, told of having examined several dead deer at different times and of finding that "the lungs were full of water." The same condition was also noted by Mr. Dan Ainsworth of Big Moose, in the few individuals he had examined. There does not appear to be any known contagious disease existing in the Adirondack deer at the present time.

It was very difficult in most instances to secure any definite figures on the number of dead deer found by various persons during the winter. Mr. Ainsworth, Jr., while cutting timber in the spring of 1927, in the Two Sister Lakes district near Big Moose, told of finding eight dead deer, among which were three bucks. He had no idea as to the probable cause of death. The carcasses lay in a balsam copse, and the animals had apparently been within reach of plenty of food. This report was partially corroborated by our finding a number of bones in the place Mr. Ainsworth had indicated. Other reports of similar nature were received, and were doubtless true, but when the actual numbers were asked for the informant usually could give nothing definite.

Mortality due to severe winter conditions is sometimes likely to be exaggerated in the minds of residents, especially when the reports are merely such as are passed on by word of mouth from person to person; the numbers are likely to increase rather than diminish. We were told by Mr. Jenkins, game warden already mentioned, that on March 13, 1926, in response to a report that deer were dying in greater numbers than usual in that territory, he made a trip from Thendara directly through the woods to Beaver River, but found no evidence to bear out the report.

A point to consider in this connection is that many of those first to succumb in winter would doubtless be older individuals; this would in effect be the same as a natural death. Next in order would probably be fawns of the year, and these would represent a greater loss.

Hunting. It is obviously beyond question that the greatest mortality among deer today occurs from hunting; and this mortality is due to increase with the increasing number of hunters. The number killed by hunters is, moreover, one about which we have some



Fig. 120. Set-back along the outlet of Falls Lake, Brandreth. A doe may be seen a little to the right of center, feeding on algae in a stagnant pool. August 15, 1927.



Fig. 121. The outlet of Falls Lake at the point where it joins the Beaver River Flow. Mats of algae can be seen on the surface of the water in the left foreground and also clinging to the dead brush. These plants were eaten in quantity along the Flow. August 6, 1927.



Fig. 122. A bed of yellow pond lilies in the inlet to Safford Pond, near Big Moose. Such beds were favorite feeding places for deer, especially in July. July 9, 1927.



Fig. 123. Raspberry patch near Falls Lake, Piseco, trampled down and eaten by deer in August.

knowledge: we know the minimum killed each year. The death rate from other causes is wholly unknown; but it is a common habit in such matters to come to sudden conclusions, and so when two or three dead deer are discovered as the result of a hard winter or, perhaps, of accidents, there are many uncritical individuals who are satisfied that they have found a major cause of the mortality among deer.

Data regarding the number of deer taken from the Adirondacks each fall, as reported by hunters, can be obtained from the reports published by the State Conservation Commission at Albany. With the special deer hunting license now required it will be possible also to know with some degree of accuracy the number of hunters who seek this particular game from year to year. During the open season the various hunting camps are the centers around which most of the deer killing takes place. An idea of the number of bucks killed at such centers may be gained, perhaps, by mentioning a few examples. At one such camp, near Big Moose, which accommodated fifty hunters, thirteen bucks were taken out in the fall of 1926 and in the fall of 1924, a buck for each hunting day of the season was bagged by the hunters working out from it. At another camp fourteen bucks were shipped out in 1926. From a third camp, which would accommodate about ten hunters, there came eight bucks in 1926. About Old Forge and along the roads in that general vicinity there are said to be hunters camping every few rods during the open season. Some of these men hunt only a short distance back from the road; others make longer excursions. The percentage of successful hunters here is smaller than in many other sections, but the total number of individuals who hunt is large, so that the kill of bucks—and possibly also of does shot by accident—is large in the aggregate.

THE BUCK LAW

The "buck law" provides, in brief, that bucks alone may be legally shot during the hunting season, and of these, only such as have antlers at least three inches in length; and no one is permitted to take from the woods any part of a deer which has no evidence of sex attached to it.

The majority of people questioned as to their opinion of the buck law, were quite satisfied with it and, in some cases, wished to have even further restrictive measures attached. Those who objected to the law, in most cases could give no adequate reasons for their stand, nor could they suggest any better regulations as a substitute for the

existing code. For purely selfish reasons some guides would prefer to have the buck law repealed; repeal, they thought, would improve their business during the hunting season, for the time being at least. Their view was that when they took a party of hunters into the woods each man would then have a much better chance to secure a deer and with this greater success their prospects of getting the same hunters, as well as others, to seek their services the following season would also be much enhanced.

On different occasions we were told of the number of does shot each fall and left in the woods out of fear of prosecution. This was advanced as a reason why the law should be modified to permit the shooting of does. Two guides at Old Forge, when questioned on the proportion of does shot, asserted that there were just as many does killed as bucks. They were obviously exaggerating in order to strengthen their argument, yet the fact seems to remain that a considerable number of does are killed during each hunting season. In final analysis, however, this proves to be no fault of the law, but due merely to carelessness or to the disregard of some hunters for the law. It is a well-known fact that many so-called sportsmen will shoot at any deer they may see, without first attempting to determine the sex, and some will even shoot at anything moving on the mere chance of its being a deer. This has made it necessary for hunters to wear some bright-colored garment when they enter the woods in order to avoid being shot at by the criminally careless gentry. The true sportsman, on the other hand, would rather lose a small buck than make the mistake of shooting a doe, not to mention a human being.

In support of better protection for deer, it was argued by certain individuals that it would be better to add still further restrictions by requiring that no "spike horn" bucks may be legally shot, but only bucks having forked or branched antlers. Thereby, it was thought, the number of does shot each year would be appreciably less, and further, that the average size of heads would increase. However, anyone who has watched deer knows that even a doe, when standing at a little distance, can easily be imagined to have "spike horns"; it is not necessarily always imagination alone for small branches of trees sometimes create the impression of antlers. But the additional restrictions mentioned would, it was thought, reduce the number of does annually shot "by mistake".

Another argument, and one which has little justification, at least as yet, is that, because of the apparently large number of "barren

does", the legal protection on female deer should be removed. It has, however, been pointed out that many of these are not barren in the true sense of the word, but have simply gone through the rutting season unmated, or, they are yearlings. Furthermore, if it is so difficult to identify with certainty a spike-horn buck, as is generally conceded, it would obviously be much more difficult to distinguish a "barren" doe from a fertile one.

If the so-called barren does were to be shot it is quite likely that we should then merely be killing off some of the best breeding stock among the white-tails.

A point that was brought up by Mr. Joe Jenkins and other hunters was the question of camp meat. Their contention was that it was reasonable that a party camping in the woods during the hunting season should be allowed fresh meat over and above the legal kill, to which the party as a whole was entitled, and that any member of the party should accordingly be allowed to kill a deer, buck or doe, for the provision of the camp. Only one such deer for each party would constitute the legal right. Of course, the idea may be most attractive from the hunter's viewpoint; but aside from the abuse which such a privilege would invite, if the need for fresh meat in the special form of venison, during the short period of the deer hunting season, is as pressing as implied, it would be interesting to know how many deer, aside from their individual legal quotas, a party of say twenty-five or more hunters would demand!

All things considered, it would seem that the present Buck Law, so-called, which is biologically sound, if rigidly enforced is a more satisfactory measure for the conservation of the Adirondack deer herd.

Some theoretical effects of hunting. A number of persons in the Adirondacks have expressed to us the opinion that hunting by the drive method may be beneficial to the deer herd in that it tends to "stir up" the animals in the various areas, causing them to move about more than they otherwise would, and thus preventing to some degree "inbreeding".

Whether these drives cause the deer concerned to travel more widely than they do normally in the rutting season, or whether any are driven out of their individual home range to become residents—provided they survive—in new territory, are points on which little seems definitely known. And "inbreeding" is of course a familiar theme among hunters, but the various evil consequences that they are wont to attribute to it are largely or wholly conjectural.

There is, however, a possibility that hunting may produce some adverse effects by interrupting the breeding activities of many deer. This would be true only if the hunting season opens before the breeding period has come to a close; and the breeding period doubtless varies more or less as to its onset and close among the individuals of any deer herd. To what extent, if any, the hunting season in the Adirondack region may interfere in this way we do not know.

Although we have not had an opportunity for study in the field during the autumn, it seems likely that extensive hunting in an area also may have its effect on the behavior of the deer. In the Piseco region, where much driving of deer is done during the open season, we had more difficulty in finding the animals after mid-July, yet earlier observations had shown that the animals were common in the same localities. This was quite in contrast with conditions in the region about Little Tupper Lake during 1929. In this territory little difficulty was experienced in finding deer at all times of the season. A count of deer in both localities, made with due consideration of sources of error, indicates that there was not a sufficiently greater number of deer per square mile in the Tupper Lake region to cause the difference noted. Other factors may, of course, enter into the question, but it was nevertheless a known fact that at Piseco much hunting had been done, while around Little Tupper Lake very little had been allowed for some years past. It seems quite logical, therefore, that deer at Piseco may have learned to become wary or retiring as the season of hunting approached.

WINTER CONDITIONS

Some general information regarding winter conditions was obtained from residents in the various areas visited, but it is necessarily rather meager. A few points upon which views were expressed may, however, be mentioned.

The main difficulty with which deer have to contend at that season is, of course, deep snow, which not only prevents the animals from moving about to get food but also covers up much food that might otherwise be within reach. If the number of deer concentrating in a given "yarding" area is not too great for the food supply available, then the animals may, nevertheless, despite their difficulties, get through the winter alive and in fair condition. On the other hand, if the number of animals is large enough to exhaust the food supply while they are still snowbound, forcing them to seek new



Fig. 124. Showing croppings of nettle along the Spruce Lake Trail. As can be seen the greater number of the shoots have been stripped of their leaves by the deer. August 11, 1928.



Fig. 125. A grubbing place. Below the hat and in front of the small hemlock may be seen a patch that has been torn up. July 23, 1928.



Fig. 126. A root grubbing place. About eight feet from a small spruce tree.



Fig. 127. Grubbing spots abundant in tall grass near edge of bushes where tripod and case are seen. Sperry Bog Stream. July 16, 1929.

feeding grounds, then considerable mortality may result, especially among the weaker individuals.

A yarding place may, according to our informants, cover a considerable area, and usually includes a swampy tract with adjacent higher, flatter ground. It was said that an east or a south slope was generally sought, presumably because less exposed; and that the animals were inclined to move to the higher ground on fine, sunny days, and retire to the lower ground at night and in stormy weather.

If the winter is one of relatively light snowfall, the deer were said to wander about considerably. The winter of 1927 was mentioned as of this type. In such a season the animals are found in smaller groups, each of which seems to keep within certain territory that apparently represents its home range. If sufficient food and water are found in a given locality a group is likely to remain there much of the winter.

One deer yarding area that we examined was in the vicinity of Little Independence Pond, near Big Moose. On a stream entering this pond, and about two hundred yards from the pond, was a beaver flow. A growth of balsam bordered the flow as well as the stream, and it was this growth that had been most heavily browsed. Another yard was found that included some comparatively high and some low ground adjacent to the upper of the Two Sister Lakes. The lower tree growth here consisted mainly of small balsams and hardwood saplings. It is not possible to say whether this yarding ground had been used more than one season, but browsing had been rather extensive.

RELATION OF DEER TO MAN

The white-tailed deer is generally considered a very adaptable animal. Like a few others of our larger wild mammals it seems to have succeeded in adjusting its life to the changing conditions wrought by the advance of civilization. It lives and even thrives in the outskirts of areas inhabited by human beings. Perhaps its chief human value lies in its interest as a game animal. Each fall many people, particularly those living in cities, derive healthful recreation from hunting it. With adequate protection it may long continue to exist in undiminished numbers in the Adirondacks. But the automobile is bringing increasing numbers of hunters into the woods each year, and protection for the animals, while all the more necessary, is likely to become more and more difficult.

Aside from its sporting value to the hunter, the deer has an equally important esthetic value to the vast numbers of campers and hikers

who annually spend part of the summer season in the woods for the mere pleasure of enjoying the forest environment. To this ever-increasing number of nature lovers the sight of a deer is an experience always appreciated. As Newsom ('26) says, "there is nothing that expresses the breath of the wilderness so well . . . as that lithe little form that moves with such delicacy of motion." It is indeed hard to estimate the full value of the white-tailed deer in the Adirondacks from this point of view.

To the farmer, however, the deer in the nearby woods may at certain times and in certain localities present more or less of a problem. In some sections of the country where these animals have become too numerous, or merely too bold, under the protection of closed seasons they have proved an actual pest, visiting fields and gardens, under cover of darkness, regardless of fences, and causing considerable damage.

But, as pointed out elsewhere, the farmer and the settler by making clearings in forests, planting fields and affording, in his more immediate vicinity, protection from natural enemies, have in many places increased the areas attractive to the white-tail. Its relation here is somewhat similar to that of such pests as the English sparrow, starling and Norway rat, or of cotton-tail rabbits, woodchucks and chipmunks close to human habitations.

In New York State the deer generally seem to be in no danger soon of reaching the stage of a pest, and we can class them only among our very desirable forms of wild life, worthy of permanent preservation.

In the Adirondacks today the deer continually come in more or less close contact with man or his activities. Settlements, roads, clearings, camps, and noisy machinery all have their effect on the behavior or the activities of the animals. Roads cut up their range into more or less isolated sections and limit to some extent the wanderings of the deer. On a road such as that from Long Lake to Tupper Lake, and on other macadamized roads throughout the territory, no doubt the constant passage of automobiles in summer prevents to some extent a normal wandering back and forth across the area. Occasionally a deer is seen to pass across the road, moving rapidly even though no automobile is near at the time, as if the macadam under foot is something of questionable nature that should be passed over as quickly as possible. Occasionally a deer is struck by a passing car. Figure 140 shows a doe that was injured in this way on the Sabattis-Long Lake road early in the summer of 1929. Both hind

legs were broken, and the animal had to be put out of its misery. A fawn that accompanied it was captured and cared for.

Guard rails along the State highways sometimes serve as a hindrance to the escape of a deer in the path of an automobile, though the animal might, it would seem, easily leap over them. No instance of unsuccessful escape of this sort was observed during the present investigation, though deer were occasionally seen to run to the end of the guard rail before leaving the road. In general, it seems, as elsewhere stated, a deer will not leap over an obstruction if it sees an easy way around it.

At points along these hard-surfaced roads one may find certain much-used crossing places of the deer. One of these was on a low ridge on the Tupper Lake road, just north of Hedgehog Pond. The same ridge was said to be a favorite crossing place for bears going to and from the Bog Stream and Sperry Pond territory. Another deer-crossing was on the south shoulder of Buck Mountain, connecting this territory on the north with that around Cat Pond to the south. Bears had also been seen to cross here. There is some doubt as to whether such crossings are used by any considerable number of deer from a larger area, or only by a few that live in the immediate locality. The latter is, perhaps, the more likely, although the fact that bears also cross along these ridges might perhaps indicate that some feature of topography is responsible for the choice of this passage by both animals.

Good highways may perhaps be looked upon in effect as an enemy of the deer, not merely because of the speeding automobile, which is a menace particularly at night, but these good roads bring more hunters easily and quickly into a region. As indicated elsewhere this may not be so detrimental if the hunting is properly controlled and restricted to the hunting season. Unfortunately, however, it appears that the automobile has become a tool of the poacher during the summer season. Such an individual usually hunts at night, cruising along a highway for many miles, on the alert for deer. Sooner or later an animal will be surprised at the edge of the road; the headlights confuse it, and it becomes an easy prey to the bullet of the poacher. The carcass is quickly concealed in the car and the hunter speeds away.

Old logging roads deep in the woods are sometimes travelled by deer, for varying distances, as well-worn trails of the animals indicate. More often, perhaps, the deer trails merely cross a logging road, which then runs in a different direction from that in which the

deer is travelling. Tracks and observations show that the animals frequently wander into and out of the tote roads as though they were merely natural glades in the woods.

Clearings around old lumber camps and cabins in the woods doubtless furnish for the deer additional places to feed in and also open places where they can wander about and sun themselves on cold days. Since the deer is a "forest edge" animal in the main, many clearings not occupied by man increase the type of habitat it favors. In such clearings around farm buildings in certain situations, as for example, at the Ten-Mile Mark at Little Tupper Lake, deer may be seen quite frequently. While the animals in such places may seem rather tame, to the casual observer, in reality they are probably more alert than those in remoter sections as one soon discovers if one tries to stalk one of them. This is only what might be expected. In their forest retreats they are at ease and their vigilance relaxed.

The activities of human beings and the associated sounds and noises, together with the sight of the human form and of his various appurtenances doubtless have their effect on the behavior of the deer living in the vicinity. Many of the animals have been accustomed to these things from the first year of their lives, and have learned that no harm is associated with them. For example, passing trains, motor boats, automobiles, in full view, are often gazed at with apparent indifference by deer that may be feeding in the immediate vicinity. But if such an object does something unusual the animals are quick to take notice and show alarm, as, for example, if an approaching automobile suddenly slows down, or the horn is sounded. Any person who has lived in deer-inhabited territory can probably recall interesting observations on the behavior of these animals where they have come into contact in various ways with man or his works.



PART II. ECOLOGY OF THE WHITE-TAILED DEER IN SUMMER, WITH SPECIAL REFERENCE TO THE ADIRONDACKS

INTRODUCTION

The white-tailed deer with its varieties occurs in more or less abundance over a great part of the wooded sections of the United States and of southern Canada. Following the occupation of the land by settlers it has disappeared from a large part of its former range, but unlike some other large game animals it is content to live on the fringes of civilization, and therefore it is found today, often in considerable numbers, in territory from which such formerly associated species as, for example, the moose and the caribou have long since disappeared.

Information about the habitat of the white-tail during pioneer days is of course now hard to obtain, since observers and writers of these early times did not often have the ecological viewpoint as we know it today. Roosevelt ('03, pp. 67-68), however, has written a description of the conditions in the upper Missouri River valley which probably gives an accurate picture of the habitat relations between the white-tail, the mule deer and the antelope in the early days. He says: "Along the ordinary plains river, such as the Little Missouri . . . there are three entirely different types of country through which a man passes as he travels away from the bed of the river. There is first the alluvial river bottom covered with cottonwood and box-elder, together with thick brush. These bottoms may be a mile or two across, or they may shrink to but a few score yards. After the extermination of the wapiti, which roamed everywhere, the only big game animal found in them was the whitetail deer. Beyond this level alluvial bottom the ground changes abruptly to bare, rugged hills or fantastically carved and shaped Bad Lands rising on either side of the river, the ravines, coulees, creeks, and canyons twisting through them in every direction. Here there are patches of ash, cedar, pine and occasionally other trees, but the country is very rugged, and the cover very scanty. This is the home of the mule-deer, and, in the roughest and wildest parts, of the big-horn. The absolutely clear and sharply defined line of demarkation between this rough, hilly country, flanking the river, and the alluvial river bottom, serves as an equally clearly marked line of demarkation between the ranges of the whitetail and the mule-deer. This belt

of broken country may be only a few hundred yards in width; or it may extend for a score of miles before it changes into the open prairies, the high plains proper. As soon as these are reached, the prongbuck's domain begins."

According to Seton ('27, p. 255), the white-tailed deer prefers the edges of civilization rather than the more remote sections, due perhaps to the fact that man soon exterminates the wolves and other natural enemies and also furnishes attractive food on his farms or in his gardens. This food is easily secured by deer under cover of darkness. The settler in clearing the forest also produces thereby certain conditions of environment which are more suited to the needs of the deer. The white-tail, says Seton (*loc. cit.*), "is essentially a creature of the woods and thickets, where these alternate with open glades." Accordingly we may perhaps classify the deer as a "forest-edge" animal. Shelford ('13) has discussed the forest edge as an environment peculiarly suited to the needs of many animals. In the undisturbed virgin forest (a type of environment hard to find today in the eastern states) there is usually very little tree reproduction and shrubbery, but at the natural edge of such a forest the larger varieties of trees give way to smaller ones and to increasing amounts of shrubs which gradually blend into the prairie or open shore beyond. Such a belt of forest edge is more like a thicket and furnishes a wider variety of environmental conditions than either the deep woods on the one hand or the open prairie on the other, and in this narrow zone will be found the greatest number of animal species. Among these forest-edge animals we may properly classify the white-tailed deer.

In the forest-edge thickets and on the adjoining prairie or shore deer find their food in abundance; a hiding place is within quick and easy reach. According to Seton ('27, p. 255), its preference for thickets along the stream beds of the West and Middle West is quite noticeable today, and the white-tail has survived and multiplied in such regions where the mule deer and other open area or hillside animals have been quickly exterminated by man. "In the East (*loc. cit.*) this habit is less noticeable because the whole country is a thicket but here too the animal chooses the borderland between sunny open and friendly cover."

In this connection it may be said that the original forest edge as it existed in the time of the first settlements is almost entirely a thing of the past in this country. The clearing and planting of fields has left an abrupt edge to forest lots, not at all like the natural forest

edges that bordered the open prairie glades of the Middle West in pioneer days, in the savannah regions of the eastern Mississippi Valley. It seems that in pioneer days the deer were found in greatest abundance in the Middle West rather than in the thicker forests of the East and North. Seton ('27, p. 246) says: "All records agree, however, that in numbers, the Deer in the Adirondacks and Maine now are as nothing to those of days gone by . . . but even this, we learn from the accounts of innumerable travellers, was far surpassed by the incredible hosts of the middle States east of the Mississippi and of Texas. In the last-named State, about 1850, I am assured by many hunters that 500 in one band were met with commonly in the half-open country."

While the original conditions of the habitat of forest-edge animals are for the most part gone today, on the other hand the cutting of most of the timber in the eastern United States has resulted in the replacing of the virgin forest by the more thickety type of woods which usually follows the operations of the lumberman; and intermixed with this later type of woodland are open glades and fields as new features. The result has been that such forest-edge animals as could adapt themselves to the changes brought about by man have survived and have even spread over wider territory. This has been true of the white-tailed deer in many sections. Newsom ('26, p. 135) has prepared a map showing the distribution of deer in 1909 and more recently. This map shows that in such western states as Oregon, Idaho, California and Nevada and in the plains states of South Dakota, Nebraska and Colorado the species has entered new territory. Here the advance of settlers doubtless brought into the plains and semi-arid steppe country new trees and shrubs which furnished cover for the deer and perhaps some forage, and a new food in the way of crops. Here also the extermination of the wolf and other predatory animals has doubtless been a factor in increasing the deer population of the region.

A study of Newsom's map shows that in the North and the East the deer have occupied new territory since 1909. Vast sections of Northern Ontario and Quebec, New Brunswick and Nova Scotia which formerly had none, now have their share of deer. This is in agreement with a statement by Allen ('29) who says (pp. 33-34): "It is hardly to be doubted that at the time of the discovery (of New England) they [the white-tailed deer] ranged northeastward along the coast of Maine as far at least as the Mount Desert region, for their remains are abundant in the Indian shell heaps there . . .

Probably the deer did not extend much farther, for they seem to have been absent from New Brunswick until about one hundred years ago, as well as from Nova Scotia.

"In southern Maine, the southern half of New Hampshire, and most of Vermont, however, they must formerly have been common, but during the century or two after the settlement of the country they became here too much reduced. This was in part due to the wolves and in part to hunting in winter when a thin crust formed that would support the hunter on foot or snowshoes but broke under the sharp hoofs of the deer, so that they were easily overtaken and knifed or shot. Even a century ago deer were apparently uncommon in the southern half of Maine but with the spread of settlements away from the coast, the clearing of the pine and spruce forests resulted in a larger extent of open areas and of second-growth deciduous woods that must have favored the increase of deer. This and the gradual extermination of wolves from northern New England made possible the spread of deer in the latter half of the century well to the northward into New Brunswick and extreme northern Maine."

In the more central states this change is shown in southern Wisconsin and in the Adirondack Mountains of New York. In these sections the killing off of predatory animals and the increase of cultivated crops have probably been factors, as have the clearing away of the forests and the increase of brushy land following the swath of the lumberman. Doubtless protective game laws have also been important.

During the course of the field work on which the present paper is based the conception of the deer as a "forest-edge" animal was continually impressed upon the minds of the observers. The animals frequent most often the habitats bordering some lake shore or field, and are in the habit of coming out into the open at certain periods during the day. Sometimes this is probably simply because of the food to be found there, but the deer seem also to enjoy coming out to the edge of the thicket and to roam about for a while each day. Apparently this is something like a reaction to the open, and this reaction may be satisfied by the lake shore, the open vly or swamp, the farmer's field or some sand spit along a stream. Along several trails which we traveled it was quite noticeable that deer tracks were scarce in the deep woods, but increased as one neared a lake or open swamp or field of some sort. This we noticed particularly on the Spruce Lake trail near Piseco, the trail to Cold Stream Lake, the



Fig. 128. Knife points to a grubbing spot in tall grass. Sperry Bog Stream. July 16, 1929.



Fig. 129. Grubbing spots in tall grass (centering around hat). Sperry Bog Stream. July 16, 1929.



Fig. 130. An old stump near T-Lake, which had been chewed by the deer. Close to the knife may be seen a few dung pellets.



Fig. 131. Examples of an old log torn by bear. Claw marks of the animal were found just below the ruler, and tracks were seen in the soft earth.

Old Albany Road from Little Rapids to Rose Pond in the Brandreth section, and the trail to Big Otter Lake at Old Forge.

It seems indeed quite likely that if a census could be taken it would show that in sections of the Adirondacks where vast areas are covered with dense forest, unbroken by lakes or clearings, the number of deer per square mile is very low.

From early writings it appears that in pioneer days deer were not very plentiful in the Adirondacks. In the middle and latter parts of the last century, however, they had become more numerous. Then followed a period of decreased abundance due to overhunting, which reached its climax about 1890. Seton ('27, p. 247) says that "this black 1890 was the low-ebb year for all kinds of big game, east of the Mississippi. Since then, organized efforts at restocking have been made in many States, with encouraging results. In 1890, the white-tail was virtually exterminated in New England, outside of Maine. . . . In New York State the Deer were found only in the Adirondacks in the Dark Time of 1890. Now they are found, in some degree, throughout the State." Pulling ('26) says, "When I was a boy, deer were unknown in Southern New York. My grandfather was born in 1828; when he was a young man small game was abundant. Partridges swarmed in the Hudson highlands, the corn-fields were full of woodcock and pigeons were everywhere, but there were no deer." After 1890 the deer probably increased in abundance in New York until very recent years when the increased number of hunters have tended to reduce the stock to some extent. In 1895 an official report (referred to by Seton, '27, p. 244) showed that 4,900 deer were killed in this section of the State. Seton estimates the population at this time as about three per square mile. In 1912 the Conservation Commission reported that there were then more deer in the Adirondacks than at any one time during the preceding quarter century (Second Annual Report, 1913, p. 33).

During the course of the present investigation frequent inquiries were made of residents and guides in the districts visited as to the comparative numbers of deer now and formerly. At Piseco and at Old Forge the opinion seemed to be that there were not as many deer today as there were fifteen years ago. Usually the blame was placed on the buck law, but it seems more likely that any recent decrease in deer may be more properly credited to the increased number of hunters, assisted by the automobile and improved trails and highways. A farmer at Piseco said that when he was a boy thirty years or more ago, deer were less numerous than now, and

that "crust hunters" would sometimes hunt all day without getting more than one or two deer.

Today the deer are apparently quite numerous throughout the Adirondacks despite the fact that several thousands are being killed by hunters yearly. As indicated on Newsom's map ('26, p. 135), they have extended their range westward in this state since 1909.

ANALYSIS OF SUMMER HABITATS

The summer habitat of the white-tailed deer may be roughly divided into four parts with reference to the activity of the animals, namely, bed spots, runways, feeding grounds, and loitering grounds.

Bed spots. Ecologically the locality where the young are born represents perhaps the most important habitat of an animal. With reference to the white-tailed deer, according to the literature on the subject, the young are born in some remote and quiet thicket, perhaps under the top of a fallen tree. Here presumably the environmental conditions in the early spring would include considerable shade, high humidity, and low evaporating power of the air. A careful analysis of this situation with the appropriate instruments might conceivably yield information on the ecology of the white-tailed deer, but the field work of the authors was started too late in the season to permit it.

Perhaps the most significant habitat in the life of the adult deer is the bed spot. Here, where the deer lies down to rest and spend considerable time we may assume that the internal physiology of the animal is in relative equilibrium with the surrounding environment. Accordingly some attention was given in the field to the matter of locating bed spots and determining, when possible, the periods that they were occupied. After attention to this question for three seasons we are forced to the conclusion that the location of a bed varies considerably with different individuals. Such spots are distributed widely throughout the home range of the animal. Probably no bed is used more than once.

It is, of course, often rather difficult to see a deer while it is lying down. The animal is likely to be up and away long before the observer is close enough to note the exact spot. Many times the animals were seen to bound away hastily from a place in the woods where it was believed they had been lying, but on our going to the spot no trace of a bed could be found. In some cases they may have been standing, at rest, when they took fright, or they may have been

moving about, feeding. But on a few occasions we came upon deer so unexpectedly that we were able actually to see them get up from the ground. And incidentally we may remark that, with respect to the speed with which the animal can start from its bed, when alarmed, we can appreciate Newsom's statement ('26, p. 56) that "Deer can get out of bed on the dead run".

We have several observations indicating that deer frequently lie down during the day in spots in the hardwood forest where the ground surface leaves no readily discernible trace of a form; there are simply a few hoof marks in the leafy mold that show where a deer has jumped to its feet. On August 9, 1929, while returning about noon from Round Lake, in the Little Tupper Lake region, the senior author started a deer near the trail and saw it leap from its bed. Instead of looking at the deer he kept his eyes on the spot and pushed through the brush straight toward it. It was possible to locate the bed (Fig. 142) by means of numerous flies which were crawling around within a limited area of smooth ground surface. The deer departed so suddenly that the flies evidently were shaken off, perhaps to remain at the bed so long as the odor of the recent occupant clung to it.

The spot was in a little hollow within a group of small spruces and hemlocks, the surface of the ground being dry and covered with evergreen needles and a scattering of small ferns and bunchberry plants. Some of the plants were pressed close to the ground and a few faint hoof marks could be seen. The morning sunlight coming through the branches fell directly on the bed spot.

A few deer were seen also in the act of lying down. One big buck was once observed to lie down in the tall grass at Dead Man's Vly, near Piseco. Again on July 24, 1929, at 4:00 p. m., a buck was seen to lie down on the border of Robinson Pond, near Little Tupper Lake. It was just within the edge of the woods on the east shore, and in a sunny spot. This buck previously had stood around for a time chewing the cud.

On August 17, 1929, while passing along the old tote road south of Ten-Mile Mark (Little Tupper Lake), the senior author suddenly found himself only a few yards away from a small three-point buck. The animal crossed the road ahead of him, without detecting his presence, and disappeared behind a large tree. Moving cautiously forward, the observer discovered that the animal had lain down with its back toward this tree. As it lay, he saw it lick its side a few times, but then it became suspicious, got up, looked around in evident

alarm and suddenly bounded away through the woods. The bed spot (Fig. 143) in this case was beside the tote road and among raspberry bushes and maple seedlings. In a slight hollow there was a little patch of grass on which the buck lay, hidden on all sides by the bushes, but with the morning sun streaming in on it.

Besides these forest beds there were also beds in tall meadow grass. Three such beds were found at Safford Pond, in the Big Moose section, and five near Nehasane Lake, in 1927; and in the Piseco region such beds were found at several places in 1928. Close to Little Twin Lake one small bed in tall grass was found during mid-summer. At Milligan Vly, on May 31, one was found in the tall grass along shore; three were found at Dead Man's Vly, August 2; and several north of Vly Lake, August 11. In the Little Tupper Lake region in 1929 grass beds were found occasionally in the Bog Stream meadows, among the alders at Sperry Pond, on the trail from Little Tupper Lake to Stony Pond, and in one or two other small glades in the woods.

The best examples of grass beds were those observed at Dead Man's Vly, near Piseco (Figs. 145-147). On August 2, 1928, at 1 p. m., the senior author started on a "still hunt" through the woods from Twin Lakes to the vly and succeeded in surprising, while it was lying down, a big ten-point buck known to inhabit that area. The animal rose hurriedly from the tall grass, about fifty yards ahead of the observer, at the east end of the vly and bounded swiftly but stealthily away into the woods. The bed it had occupied was easily found. It was in the midst of a patch of grass between two and three feet high; the sun was just striking the spot over the top of a tall tree. The bed itself was simply a form where the grass was matted down over an area about four feet by three. The bed was dry, but a small "swamp brook" ran within six feet of it. About five feet away was a second, similar bed, and about twenty-five feet farther out toward the main vly, was a third one. Tracks indicated where the deer had passed from one bed to another. By the most recently occupied bed was a single heap of droppings.

This same deer had been seen on the main vly at 9 p. m., on a previous morning; and on July 14, at 2:35 p. m., had been actually seen to lie down and get up, twice, well out on the main vly.

From these observations it appeared that this particular buck was in the habit of lying down in the open during the middle of the day and that he usually changed his bed a few times during this period, no doubt taking a good look around each time he got up. It also



Fig. 132. Showing an old rotten log chewed by deer. The fine shredding of the wood fibers is typical of the work of deer.



Fig. 133. A small salt lick near T-Lake Mountain fire station. The old stump had been thoroughly chewed by the deer. The fallen log showed signs of porcupine gnawing when the picture was taken, and no deer had been seen here for several days.



Fig. 134. Salt lick near Keepawa. Salt had been placed on the stump which had been thoroughly chewed by the deer. The ground around was packed hard by constant tramping.



Fig. 135. The forest floor showing scattered pellets of deer excrement in the left center of picture.

would appear from the conditions about these and other beds, that deer drop little dung on the bed grounds. At Vly Lake (Fig. 148) several beds were found in a small open space surrounded by dense thickets of small saplings, etc. This was on low ground covered with tall grass, ferns, raspberries, and cleavers. Only one heap of droppings was found though the tracks indicated that at least two deer had occupied the beds.

In all the observed cases the bed spots seemed to have been chosen so that the animal might lie in the warm sun, and no doubt this is an important factor in the choice of a spot. Also the ground surface must be level or grassy and dry. The matter of a vantage point from which the animal may see approaching danger does not seem to be so important; at least in two of the cases mentioned the bed was located in a slight hollow and would not provide a lookout to the surrounding locality. No doubt deer also lie down at some time during the night, but the nature of the bed spot then chosen and any factors that might determine the choice would of course be difficult to determine. One doe was seen to lie down in the meadow (Fig. 149) near Ten-Mile Mark, just before dusk, on the evening of August 25, 1929.

Runways. In moving about in their home locality deer frequently follow more or less definite paths, or runways (Figs. 150-156). These are significant in interpreting the activities of the animals, representing as they do definite wanderings. They vary a great deal in length, some being very short. In the depths of a certain thicket one may occasionally find short paths past bushes or around fallen trees. In such situations the runways usually seem to start nowhere and end nowhere, as if the deer simply happened to travel the same direction several times, found the passage easy and unobstructed and continued to follow the same route until a path was formed. Perhaps the path may have resulted from the wanderings of different deer at different times. Beyond the thicket or windfall the various deer probably set out in different directions through the witch hobble and so the first trail seems to vanish as mysteriously as it began. However, such trails may indicate that deer in the locality follow much the same routine day after day, visiting different parts of their home territory at certain times each day, just as cattle will be found in different parts of a pasture at certain times. The routine is, however, continually changing, though slowly, and in due time a noticeable system of trails is worn. Such a trail system if carefully examined may prove to have some significance. Perhaps

it leads through a depression between two ridges, or over the ridge itself, and serves to connect one swamp with another, or is the way to a lake shore or other feeding ground. It may run parallel with a bog that is rather inaccessible as a feeding ground but that nevertheless furnishes a chance to look out over open territory. Along any lake shore runways may usually be found which are made by the deer wandering along the shore line to feed here and there; and perhaps the most marked runways of all are those which lead from the surrounding woods to the shore. Close to the water these may be well marked and the soil may be packed hard by the frequent tread of hoofs. If one follows such a runway back from the shore it usually is found to lead into higher ground, by following some shallow ravine or perhaps a hillside. Still farther from the shore the runway usually fades out in the many witch hobble thickets. Here the deer returning from the shore evidently take different directions at different times, perhaps browse about a little and later lie down in some rather open space. In general the runways follow the easiest course. The deer does not, in its usual daily movements, jump over an obstruction if it can go around it. However, the seemingly inviting man-made trails are not much used by the deer. Occasionally the animals will follow such a trail for a ways, but usually their tracks are seen merely to cross.

Frequently deer runways may be much traveled and long. In the district north of "The Slang", at the outlet of Little Tupper Lake, were found several well-worn runways which extended to a considerable distance on each side of the road, passing along the base of low ridges and vanishing finally into a swamp. Other long runways were found in the locality of the reservoir south of Ten-Mile Mark and near the outlet of Antedeluvian Pond. It seems likely that some of these longer runways are used a good deal in the winter time.

The grassy meadows along Bog Stream were covered with a network of runways, of which some of the better defined ones led back into the brush. On August 7, while one of the authors was watching the meadows by means of a telescope, four deer were seen to wander in the direction of the woods, in single file, about 9.00 a. m. No doubt they were following a runway. The group broke up just before reaching the woods, the leader seeming to resent the proximity of the following deer. Their sex could not be determined on account of the distance.

Grassy areas along Otter Pond Brook and near the shore of Antedeluvian Pond also showed well-worn runways.



Fig. 136. Deer droppings. Just to the right of the compass is a typical cluster.



Fig. 137. Showing a patch of porcupine dung pellets, easily confused with deer pellets.



Fig. 138. Along Fall Stream above Vly Lake. The sand spit shown is representative of others on which the deer seemingly liked to wander, probably from a desire to get in the open. July 9, 1928.



Fig. 139. A freak three-legged buck shot near Piseco in 1923. No sign of left fore leg was seen, according to accounts. The animal was very poor and lousy. (Photograph courtesy of Mr. Anibal, Piseco, N. Y.)

Near "The Slang" much traveled runways were found along the sides of the small hills that stand out abruptly from the surrounding swamps (see Figs. 164 and 165). These hillocks are covered with a thick growth of laurels among scattered evergreen trees, through which the deer had worn narrow runways. Usually the runways (Fig. 155) did not lead over a hillock but along its side and around it, thence off into the alder swamp behind it. Apparently the deer did not stop long on the hills, but went farther back to loiter or lie down, after feeding in "The Slang".

A common place to find runways is near lake or pond shores where deer are accustomed to wade and feed during the early summer. Many of these paths will lead down to the shore from the low ridges farther back, some will form an indistinct network near the water's edge, while others lead over a steep headland to the next stretch of low shore beyond. Near the feeding ground trails are likely to be confusing and irregular because the animals, in addition to feeding in the water, will wander about near the shore for a time and browse. Good examples of shore runways were found near Sperry Pond, Lower Cat pond, Robinson and Antedeluvian ponds (Little Tupper Lake, 1929).

Another line of travel that must be listed under runways was noted in several places where the deer were accustomed to pass back and forth in the shallow water, just at the shore line. Notable cases were at the north shores of Sperry Pond, Stony Pond (Fig. 157), at Little Tupper Lake, and at the east end of Big Flatfish Pond. In each of these instances the shore vegetation ended abruptly at the water's edge and the water next to it was shallow and the bottom sandy. Several times deer were seen to wander along these shores, ankle deep in the water, and feeding more or less on the slightly overhanging bushes. Of course such a passage along a submerged beach would leave no very noticeable trail, but in the activities of the deer it was the equivalent of a runway.

Old tote roads, long unused by man, are occasionally traveled by deer. Instances of this kind were noted in the reservoir region south of Ten-Mile Mark at Little Tupper Lake, where deer had followed such roads sufficiently to have made distinct runways.

Recently constructed tote roads are not likely to be used much by deer. Occasionally, while traveling along such tote roads, one will see the fresh track of a deer which had wandered into the road, followed it a short distance and left it again; but usually the tracks are rather those of a single deer which passed that way but once.

They represent the random wandering of the feeding animal rather than the repeated travel in a certain direction which would result in a definite runway.

In general we may conclude that the runway of the white-tailed deer shows the tendency of the animal to pass the same way at intervals in its periodic rhythm, each time taking the path of least resistance, going around obstructions when possible. The final result is a beaten path or runway. With change of season and the development of other food plants in a new locality new paths will be worn, and the old ones abandoned for the season, to be used again, perhaps, the following year. Again, if a windfall occurs across the path, the deer will usually go around it, or even choose a new path or go to a different point than the one to which the old runway led. The deer chooses to walk an easy trail, when it can, and would rather go around a fallen tree than leap over or crawl under. The runway therefore represents, perhaps, in general the easiest route in the existing situation.

Feeding grounds. The feeding places of the deer on the lake shore, swamp edge or field are important parts of the habitat of the animal, and the seasonal condition of the food plants determines much of its activity. Food is indeed one of the most important factors in determining the local distribution of deer, as of many other animals. Deer will eat during the year a wide variety of plant material, as discussed in a previous section of this bulletin, and the animals wander about from one place to another, within certain limits, in response to the progressive development of food plants in various parts of their home range. In the early summer the lake shore attracts them, and in early morning and late afternoon they come here to feed, finding several kinds of favored plants growing in the shallows and on the mud flats. A little later in the season, the lily pads farther off shore attract them, too, and they frequently swim out and nip these off. Probably at this season all the deer in a locality will come to the shore to feed at some hour of the day. The time of day when the animals will be active at a shore feeding ground will vary with the locality. In remote sections the animals come to the shore in the afternoon, generally, while near a lake frequently disturbed by human visitors, they are likely to stay back in the woods during the day and come out to the shore only in early morning and at dusk. The daily feeding rhythm is adapted to the local situation.

In addition to the lily pads and other vegetation in the shallow

water, it seems likely that deer eat also certain roots found here. This is especially true on broad mud flats where the animals find such food below the surface of the mud. Cases of this sort were observed in the Piseco region. In addition to such food secured on mud flats, deer occasionally "grub" for roots in the woods, where small patches of ground are frequently found torn up by these activities (Figs. 125 and 126). In such rooting the animals do not remain long in one spot, but dig a little here and a little there. Spots of this kind were noted particularly near T-Lake in the Piseco region and at the west shore of Stony Pond near Tupper Lake. On one occasion at Loon Pond, the senior author observed a buck feeding in this way, at a distance of about fifty feet. Later he found numerous fresh grubbing spots were located where the animal had first been. This observation verified previous ones that the deer do not use their hoofs in this rooting process. The earth apparently is simply rooted up with the muzzle and incisor teeth. Such spots usually show a central depression deeper than the rest. Grubbing spots in the woods are usually found in places where the surface is relatively free from green vegetation, and is damp, earthy and fibrous in texture. Whether any special root is sought is hard to determine, but usually one or more small spruce and birch trees occur within ten or fifteen feet.

Another interesting grubbing spot was found near Bog Stream (Little Tupper Lake district), at the upper end of "the hay meadows", as locally known. The animals had grubbed out considerable patches of ground that had been covered by tall grass. Here as elsewhere the surface showed no signs of having been scratched by hoofs. Doubtless the grass roots had served as the attraction, though alders also were growing near by and some of the rootlets of these may have been included.

In late summer the shores are no longer visited so frequently by the deer. No doubt the lily pads and other aquatic vegetation have now passed beyond the succulent stage, while various forest plants are coming into favor. Accordingly the animals are now found scattered throughout the woods, or, perhaps, resorting to grassy meadows. In the meadows, in addition to juicy blades of grasses there also is found a variety of herbaceous plants that are eaten by deer. In other localities, again, raspberry bushes, nettle patches, etc., may be the chief article of diet for a time. During this season, in the region of Little Tupper Lake, the deer seemed for the most part to be simply wandering at random through the woods, remain-

ing in no definite feeding area and nibbling a variety of bushes and shrubs here and there.

The grassy meadows along Bog Stream were visited nearly every morning and evening at this season, by several deer, on sunny days, and the same was true for a grassy clearing north of Otter Pond outlet. No doubt if the grass flats near Antedeluvian Pond had been under observation in early August, deer would have been found feeding here, also. To the meadow near Ten-Mile Mark House the deer returned during late August after having been absent for a time, but their absence doubtless was correlated with the mowing of the meadow, which took place early in August.

To the deer the farmer's field presumably represents merely an attractive feeding ground, and is visited regularly by following runways very much as in the case of any natural feeding ground within its home territory. It involves of course an additional factor, namely, that of disturbance from the farmer or his dog. This is likely to result in a change of the daily rhythm, as discussed in another place.

Swamps of certain kinds also attract the deer. If the shore is marshy but grades off into open water as in the case of the marshes along the outlet of T-Lake, near Piseco (Fig. 92), the deer are not likely to frequent the place so much. On the other hand, in alder swamps it is not uncommon to find deer feeding at various times of the day. Frequently such a swamp may be so wet and soft that the animals have to jump from hummock to hummock when fleeing hastily from a disturbance. Such a situation obviously represents a feeding ground purely, and not a resting or loitering ground.

Loitering grounds. Located usually not far from the feeding grounds one may sometimes distinguish what we have called the "loitering grounds". Here the deer stand about and chew the cud a while before going farther back in the brush, perhaps, or out into some open spot to lie down.

In several instances we found such loitering grounds a short ways from the feeding place. They were indicated by the numerous dung heaps and tracks in a rather open place in the forest. On the Beaver River Flow near Brandreth, a spot was found where three runways led into a grove of pines. Here, on an area about ten yards square, the ground was much trampled. The heaps of dung were in this case most numerous along the runways near by. Similar spots were found on the west shore of T-Lake, on the north shore of Little T-Lake, and just north of Scotch Lake. Another example was a



Fig. 141. Yearling doe in an old clearing on the Nehasane preserve. It was foraging on the white clover that grew here in abundance. Photograph by B. A. Scudder.



Fig. 140. Doe struck by an automobile on the highway. Both hind legs were broken and the animal had to be shot. July 10, 1929.



Fig. 142. A bed spot in the woods near Hedgehog Pond. The deer had been lying near the center of the photograph. August 9, 1929.



Fig. 143. A bed spot amid raspberry bushes. A three-point buck was found lying down at spot shown just in front of the pack.

small steep ridge at Piseco. Two does were frequently seen feeding in a pasture at one side of this ridge, and when startled usually ran up the ridge. Examination showed numerous dung heaps and tracks among the trees on the ridge top, and a runway leading down the farther side toward the unbroken woods beyond. So far as could be determined from the signs the deer loitered about somewhat on the ridge-top, after feeding, and then went farther into the woods to lie down. Whether the deer ever lay down on these loitering grounds or not was hard to say, but the evidence seems to indicate that they do not generally drop dung on the beds that are in tall grass. It seemed in general true that numerous dung heaps and tracks distributed irregularly over an area of rather open forest floor was an indication of a loitering ground, while a bed-ground in the forest was indicated simply by a few crushed herbs, if present, or by a more or less indistinct form. In tall grass the beds are, of course, easily recognized.

When the animal has been feeding in the water during the early morning hours it will usually return to the shore, at about eight or nine o'clock, and stand in a sunlit spot in the woods near by, till its coat has dried; and then move farther inland to feed and browse, or perhaps lie down for a time. Instances of such procedure were observed at "The Slang" and at Moonshine and Robinson ponds during the season of 1929.

During the latter part of the season several deer were observed loitering about the grassy meadows along Bog Stream. The observations were made with the aid of a telescope from the fire lookout tower on Buck Mountain about a mile away. On August 8, 1929, a bright sunny day, the senior author watched from this tower nearly all day. Owing to the heavy fogs which hung over the lakes of the region nearly every night, observations could not begin till about 6 a.m., when the fog lifted rather quickly. Two deer could now be seen at separate points on the meadow, standing quietly in the sun, and, no doubt, chewing the cud. After a half hour one of them began to move about and feed; the other remained standing in the same spot for nearly an hour. As the morning advanced several more deer began to appear on the flats and feed in the tall grass, but all moved off into the near-by woods before 10 a.m. It is probable, too, that at the time these observations began, other deer were basking in the sun at points which could not be seen from the tower. On cloudy days few or no deer were to be seen in these meadows.

On August 13 a doe was watched for nearly two hours in the

grassy swamp at the east end of Moonshine Pond, near Little Tupper Lake, and during this time, in the late morning, it fed and wandered about in the grass and shallow water, now and then swimming in a narrow bay. Thereupon it ceased these activities and stood in the tall grass for a while and chewed the cud, at one time remaining in one sunny spot for 45 minutes.

In such cases, as just mentioned, sunlight seems to be an important factor in determining the loitering places. Whether in the woods or in open grassy meadows all instances noted were spots exposed to the direct rays of the sun. In the deep woods such a spot may be merely where a small patch of sunlight falls between the trees.

Following the loitering period the deer may continue feeding in a leisurely way, or perhaps, seek out a bedding ground in the forest and lie down for a while.

The favorite summer habitat. It is along the low lake shores that a combination of factors makes up, perhaps, the most favorable environment for the deer in the early summer. If one examines a topographic map of a region not too much disturbed by man, it is possible to predict which shore of a lake will be most frequented by the deer in the summer months. Examples are the west shore of T-Lake (Figs. 161-163), and White Birch Lake in the Piseco region (Map 5). Here, as shown by the contour lines, the shore is backed by a considerable tract of low land. This is forested by a mixture of hemlock, spruce, and especially hardwood trees such as birch and maple. The shrub stratum consists for the most part of a rather dense tangle of witch hobble, striped maple, ferns, etc., and various small plants, especially *Oxalis*, are common in the more open spots. In this area various short runways are to be found, here and there a chewed stump or log, or a spot where the deer have nosed into the soft earth on some hummock, in search of roots. Dung heaps are numerous, and it is evident that this is a favorite locality for deer in summer. The supposition is amply confirmed by the fact that one sees more deer on these low-lying shores than on the shores flanked by higher ground. Such a low-lying shore usually runs off into shallow water where a bed of laurels or similar vegetation furnishes a certain amount of browse and also protects a good growth of deer grass and algae, other favorite food of the deer. Another example of similar kind was seen at Rock Lake in the Brandreth section. This lake is situated in the Nehasane Park, an excellent locality for deer, and was visited three times during the summer of 1927, by one of the authors, when its shore-lines were carefully

examined for signs of deer. The shore of this lake is high and rocky except for a limited strip around the northwest arm. This strip of low shore was the only place where deer were found.

WINTER HABITAT

In winter the ranging territory of the deer becomes more or less circumscribed. At the close of the breeding season and with the coming of cold weather the animals tend to group themselves into small bands, which later, if the snow becomes deep, may become snow-bound for a shorter or longer period within a restricted locality or "yard". Since the present study was limited to the summer months, the subject of deer yarding received only such attention as was possible by examination of localities where yards in past winters were known to have existed, or where signs pointed to such existence. Most of the information on which the following account is based was gained from the literature or from questioning the residents of the districts.

In such winters as those of 1925 and 1926, when there was a heavy fall of snow, the deer are, naturally, said to yard in much more restricted areas than in more "open" winters. In fact, in so-called open winters it is a question whether deer actually yard in the usual sense of the word. A deer yard may frequently cover a considerable area, usually taking in a stretch of swampy ground which extends to a higher flat, generally on an east or south slope, in more sheltered surroundings. A swamp edge is frequently chosen presumably because of the food, shelter and water here available. However, in the Piseco region deer were said to yard near the top of Outlet Mountain. This top was examined during the summer of 1928 and it was found to be cut by deep ravines leading down the west side. In these ravines old runways and a good deal of close-cropped witch hobble and various other shrubs indicated that the report about deer yarding here was true. In the winter (as stated in Part I of this report) deer are said to seek higher ground on fine days, but come back to the lowlands at night and in stormy weather. Accurate data on this point are rather lacking.

A yard consists of a number of trails crossing each other at various angles and forming more or less of a net work, sometimes radiating to some extent from some central resting place. It is an area of land in which the deer have formed trails while plowing through the snow in seeking the necessities of life. In some cases it approaches nearer the appearance of a yard in the generally under-

stood meaning of the term, when, due to the great depth of the snow and their weakened condition, the deer are unable to move about freely but herd together in a more restricted area, browsing off all available food. The trails in such a yard may become packed from constant use.

The number of deer in a yard is said to vary greatly. A guide in the Adirondack League Club park, near Big Moose, said that he had seen as many as thirty in one such yard. Mr. Stanton, a game protector near Piseco, mentioned a yard on the west branch of the Sacandaga River where he believed as many as 100 or 150 deer had spent the winter together. In the areas studied during the summers of 1927 and 1928 several yarding places, indicated by the signs, were found, and all of these seemed to have been relatively small. Probably six to twelve deer represent more nearly the usual number of deer in a yard.

Near Little Independence Pond, southwest of Big Moose, we examined what evidently had been a deer yarding place. Intermittently for half a mile along a stream which feeds the pond, the small balsams had been browsed. The area was swampy. Most of the browsing had been done along a beaver flow two or three hundred yards from the pond itself. Another such yarding place was near the upper of the Two Sister lakes, at the head of Big Moose Lake. Here were indications that there had been a rather extensive yard among small balsams and scattered hardwoods on comparatively high ground adjacent to low land and the lake. The croppings may have been the work of several deer during one season or of a smaller number that had yarded there several seasons. Along the Old Albany Road to Rose Pond, in the Brandreth section, there were balsams which had been similarly cropped. However, this was on high ground and at least a mile from any stream or pond, and, the majority of the croppings were on trees immediately adjoining the trail.

In the Piseco region, also, a few yarding places were examined. Near the top of Outlet Mountain, south of T-Lake, as before mentioned, deer had evidently wintered in the ravines and among witch hobble thickets. Just north of T-Lake there was evidence of a more extensive yard. Here the land rises from the lake shore up into the valley of the inlet brook in a series of swampy terraces, thickly covered with a growth of hardwood saplings and witch hobble. Old trails and much evidence of browsing pointed to this as a yarding place; and several guides and other residents of the district



Fig. 144. The bed ground of a fawn. The animal was lying just in front of the rotten log where the hunting knife is placed.



Fig. 145. Tall meadow grass at eastern end of Dead Man's Vly. A ten-point buck was startled from his bed here at mid-day.



Fig. 146. The bed occupied by the ten-point buck at Dead Man's Vly. The matted grass in the middle foreground indicates the spot where the animal lay.



Fig. 147. A bed spot at Dead Man's Vly. The bed had been occupied by an unusually large deer. Below the compass may be seen a heap of droppings.

referred to it as such. Some expressed the opinion that it was a place where only does had yarded, others that it was a buck yard. No satisfactory explanation of this fine distinction was forthcoming. A small yarding area was found in the dense woods north of the west end of Dead Man's Vly, and another on the east shore of Cold Stream Lake, near Piseco.

DAILY RHYTHM

Opinions seem to differ as to whether the deer is to be considered chiefly nocturnal, crepuscular, or diurnal. The observations obtained during the three seasons in the Adirondacks seem to show that their activity in this region largely depends on local factors. Deer in different sections will come at different times of the day to their favorite feeding grounds. Merriam ('86, p. 111) states that "in localities that are much frequented by man they keep their beds during the greater part of the day, and feed mostly by night; while in remoter sections the reverse seems to be true." Much that was learned in this investigation more or less substantiates this statement; but the animals may, strictly speaking, be more crepuscular than nocturnal where they are undisturbed.

Seton ('27, p. 263), speaking of the summer life of the fawns and does, says: "their daily lives now are as unvaried as they can make them. They rest in some cool shelter during the heat of the morning, and about noon they go to their drinking place.

"The mother Whitetail, after a copious draught, sufficient to last all day long, retires again with her family to chew the cud in their old retreat, where they escape the deer-flies and heat, but suffer the mosquitoes and ticks.

"As the sun lowers they get up and go forth stealthily to feed, perhaps by the margin of the forest where grow their favorite grasses, or the nearest pond, where the lily-pads abound; and root, stem, and leaf provide a feast that will tempt the deer from afar. They munch away till the night grows black; then sneak back to some other part of the home covert—rarely the same bed—where they doze and chew the cud till dawn comes on. Then, again, they take advantage of the half-light they love, and go foraging till warned by the sunrise that they must once more hide away."

This description is that of a crepuscular animal and in a general way indicates the habits of the deer over most of its range. It applies especially to the doe with fawns. However, as stated above, the deer generally of a given section, as well as individuals, may vary,

in this respect, from those in another section, due to factors peculiar to the locality. In our study of 1927, at Big Moose and Brandreth we found that the time of feeding for the majority of deer observed was late afternoon and evening.

An instance which shows how the number of deer coming out to feed increases as the afternoon advances occurred on July 18, in the set-back along the outlet of Falls Lake. At noon there were here twelve deer feeding; at 5:00 p. m. there were eighteen; and at 6:00 p. m. there were twenty-four. Again on July 26, twenty deer were here seen at 6:40 in the evening.

Residents of the Adirondacks frequently remarked that it would be necessary to get out early in the morning and again late in the afternoon if observations were to be made on the white-tail. However, our actual experience repeatedly proved that this was true only near settled communities and about lakes visited a great deal by people. On lakes and ponds in the more remote districts where there was very little disturbance by man, deer were more often observed to come out to feed in the middle of the day. In these more remote places experience had taught them that there was less to fear. On the other hand, back of a sawmill at Brandreth was an open space where deer repeatedly were to be seen in the evening towards dusk although there was considerable human activity about this mill during the day. This activity did not, however, disturb the animals in their forest retreats, and as quiet came with evening they ventured forth, impelled by curiosity or other inward impulse.

Both for the Big Moose and the Piseco districts the decrease in the numbers of deer seen feeding on the shores of certain lakes during the day time is evidently due mainly to the many fishermen visiting these lakes. If deer are frightened a few times during their regular feeding hours they are likely, immediately following, to change their periods and come out at some other hour. On Safford Pond, near Big Moose, in 1927, there were few fishermen before July. Up to that time deer were commonly seen during the afternoon, sometimes as many as eight at one time; but after several fishermen had begun to visit the lake, only one or two deer were usually to be seen.

In the summer of 1927, both at Big Moose and at Brandreth, few deer were to be seen in the early morning hours. Whether this was simply coincidence is a question, but that is possible. At Safford Pond, for example, on July 2, at 5:00 a. m., no deer were seen although it was a clear, bright morning, with a mist rising from the water. At 6:00 a. m., a doe was seen; but not another deer in the

vicinity until 9:00 a. m. Whether this was an unusual morning is also a question, though one would say not. On June 27, at 2:15 p. m., there were eight deer out at one time at this lake. Early morning visits were made to the outlet of Falls Lake at Brandreth on different occasions, but with no better results. The highest count for the morning observations was eight does, at 5:20 a. m., on July 19, five of which had been feeding since 4:25. It should be stated here that as the summer advanced early morning trips very frequently were useless, due to the heavy mists which now characteristically hung over the lakes.

In contrast to the situation in the localities just mentioned, at T-Lake, in the Piseco region, during the same season the greater number of deer were seen in the early morning. They customarily came out about 5:00 a. m., and went back into the woods between 8:00 and 8:30, and after that hour only an occasional deer was seen before the next morning. The activity around this lake shows very well the way in which the deer respond to human interference, for during the season when they came to the lake most frequently there were parties encamped on the State camping grounds at the south end. During the day and in the evening these people would create considerable noise in their varied activities. In the early morning hours, before they were astir, we saw the greater number of deer. By 8:00 or 9:00 o'clock, when the campers began to move around, the deer retreated, presumably to their bed grounds in the woods. In 1928 there were not so many parties camping at this lake, due probably to much rainy weather. We found then that the deer came out both in the morning and in the afternoon.

These observations seem to show clearly enough that the deer at times regulates its visits to favorite feeding grounds with reference to human disturbances such as those mentioned. If a disturbance is too great the deer may, as mentioned in another connection, desert the locality.

In localities visited by few people it appears that the deer may show a more distinctly diurnal rhythm. This was most noticeable at Rose Pond and Nehasane Lake, in the Brandreth area, where we saw deer in comparatively large numbers from 11:00 a. m. or noon on. The same was true at the two Sister Lakes, near Big Moose, and during the two days spent here almost as many deer were observed in the afternoon as in the evening. As a rule, only one or two persons visited these lakes during the summer months.

At Little Tupper Lake, in the summer of 1929, heavy fogs made observations in the late evening and the early morning very difficult.

A few mornings were spent in the fire lookout station on Buck Mountain, from which it was possible to obtain a good view of the grass flats along Bog Stream a mile away. As soon as the fog lifted, about seven o'clock, deer could be seen feeding at various points on the meadow. They usually remained in sight for an hour or two and then wandered off into the woods. How long these animals may have been out on the meadows before our observations began is not possible to say.

Collectively it seems that deer do not show any great regularity in feeding hours over their Adirondack range, except as conditioned by the nearness and remoteness to human habitations or activities; but individually there is considerable regularity. On Thirsty Pond, near Big Moose, for example, three does were in the habit of coming out evenings to feed along the shore, during the latter part of June and the first week of July. The animals came out between 6:00 and 7:00 o'clock and would stay until dark unless some boatman was on the lake. On two occasions we visited the lake at dawn, but deer were not out either time. In another case a doe which had two fawns came out usually between 6:00 and 7:00 p. m., and from 6:00 to 8:00 a. m., along the flow grounds opposite the camp at Little Rapids, where it would browse on the raspberry canes. Again, a doe which fed in the set-back near Brandreth station usually appeared about 3:30 p. m. to wade around in the mud and water, feeding upon algae and young grass shoots. This doe was quite tame from having become used to the presence of people. At Piseco, a spike-horn buck, on four different occasions, was seen to appear at about 11:00 a. m., to feed in Cold Stream Lake.

LENGTH OF FEEDING PERIOD

The length of the feeding period of a deer doubtless varies greatly with the individual and with the abundance of food, or other factors. Sometimes an individual will wade around in a comparatively restricted area in a pond, as for instance a spike-horn buck that fed for an hour at Jessup Lake (in the Piseco region), within a radius of about seventy-five feet, from 3:15 to 4:15 p. m. At other times an animal may remain out for a considerable period. On two such occasions a doe was observed to wander along the greater part of the west shore of T-Lake, now in and now out of view as it made detours around logs and trees. When feeding in this manner the animals almost invariably keep going in one direction and do not double back on their tracks. One of the does mentioned, observed



Fig. 148. View of a grassy glade north of Vly Lake where several bed spots were found in the tall grass.



Fig. 149. Meadow at Ten-Mile Mark. A favorite feeding ground in summer. August 29, 1929.



Fig. 150. A runway on a ridge top near Piseco. The tracks led across the end of the log and past the small axe in the middle distance.



Fig. 151. Another view of the runway across the top of a ridge near Piseco. The hat is lying in the path.

on July 11, 1928, continued to feed for nearly two and a half hours—from 12:05 until 2:30 p. m.

It was generally true that the deer we saw continued to feed for a longer period late in the afternoon and in the evening than when they came out earlier in the day. Many that were seen to come to a lake or pond at mid-day apparently came to drink, only, and remained but a short period to feed. In the afternoon, however, an average feeding period would be about one hour. On the other hand, if a deer came out to feed at about 6:00 or 6:30 p. m., it was more than likely to remain at least until dark, when our observations came to an end. The fact that the individual deer of a locality feed for longer periods in the evening is doubtless one reason why one often finds more of them together at this time.

INFLUENCE OF LIGHT

In the near vicinity of man and his activities it is possible that waning light is a stimulus prompting the deer in its daily rhythm. The animals have learned from experience that the dim "half-light" of dawn and dusk is the safest time to venture forth. In the late afternoon the movements of an individual deer probably follow the advance of this half-light. The shadows first fall in the thickets, and the animal begins to move about and feed on the plants near the bed grounds. It is still too light for it to feel at ease on the shore or in the fields, but as evening advances and dusk settles in the thicket, the edge of the woods presents more attractive light conditions, and the deer accordingly appears there. Still later it comes out in the open clearings or onto the shore and feeds until darkness sets in there, too. A doe that was frequently seen feeding in the edge of a pasture at Piseco, in 1927, always came forth just as darkness set in, though frequently we began to watch for it an hour or so earlier, screened behind a brush-hidden fence. A few minutes after the deer appeared it would be too dark to make out more than its indistinct shape.

In the morning the reaction to the light probably would require to be explained differently. But doubtless the same half-light prompts the deer to become more active and to feed or move about near the bed ground, or perhaps to go directly into the open. Observations at T-Lake in the season of 1927 indicated that the greatest activity of deer on the lake shore itself was not at gray dawn but a little later, about at sunrise. Perhaps the animals, having fed a bit farther back in the thickets and swamps, are inclined to

come to the shore to drink before feeding again. The bucks, especially, do not seem to stay at the shore very long at this time; the does may remain longer. The movement to the lake shore in the early morning is toward the brighter light; but the stimuli concerned at this period may not all be the same as those of evening.

In this connection the daily rhythm may also vary somewhat, it appears, with the moon, for Seton ('09, p. 101) says: "A favorite time for such a foray [into the farmers' gardens] is in the moonlight; and the rising of the moon is, in all much-hunted regions, a signal for the deer to go forth. Many supposed irregularities in their habits will be explained by reference to the lunar calendar."

Weather conditions likewise cause some variations in the daily rhythm. During the summer of 1927 one of the authors spent fourteen mornings watching the west shore of T-Lake during the hour from 6:00 to 7:00 a. m. Conditions were practically the same except for weather changes. The number of deer seen each day was recorded, together with the condition of the weather. The only conclusion that could be drawn from the record was that the deer came to the shore most often on clear sunny mornings with a mist rising from the water during the early hours.

At Brandreth, during the same season, an attempt was made to correlate the appearance of deer at lake shores to feed, with weather conditions, such as cloudy, bright, rainy or windy days, and lower or higher temperatures, in such a rough manner as might be possible without instruments. From this attempt only a few broad generalizations might be ventured. A day of lowering temperature, such as usually follows rain, but still dull and cloudy, was a poor time to see deer out foraging. It was usual to see them in greater numbers on comparatively warm days, whether clear or cloudy, and windy days were no exceptions although it is well known that during the hunting season deer tend to skulk on such days. The fact that insect pests are less bothersome on windy days may be an incentive for the deer to come to the open places. On those rainy days on which our observations continued, practically no deer were seen. Still a doe at Little Rapids, previously mentioned, was observed to bring her two fawns out during a steady rainfall. Heavier showers seem to drive deer to the shelter of the woods as was noted on August 5, 1927, at Nehasane Lake. During the afternoon of that day occurred two heavy downpours each of which drove the deer that were feeding along the shores to cover.

INDIVIDUAL BEHAVIOR OF THE WHITE-TAIL

The habits of individual deer are presumably correlated with the preservation of the life of the animal. The white-tail is primarily a swamp-thicket animal and a "skulker", its existence dependent upon its ability to evade its enemies in its natural environment. Its keen senses quickly detect the presence of danger, and its method of progression through the brush enables it to escape quietly or quickly as the occasion may demand.

Normal undisturbed behavior. The normal gait of an undisturbed deer in its native haunts is a walk, and as long as possible it will continue at this easy pace. Only when startled or otherwise excited will the animal break into a run. Normally while thus walking along a runway or about a feeding ground the deer carries its head rather low (Fig. 77) and looks casually this way and that in search of some tempting bit of food. If the path or shoreline is brushy it will pick its way here and there, stepping high occasionally over some obstruction. On rare occasions it may stoop and crawl under a fallen tree in its path, or if this is not possible, it may reluctantly jump over or go around it. The suppleness of the animal's body is then quite noticeable. Occasionally the animal will find itself pocketed behind a greater obstacle; it will wander into a corner from which there is no outlet except by leaping over a fallen tree or a ditch, or else return by the way it came. At such times the animal looks this way and that for a moment or two and finally gathers its hind legs under it for one powerful leap over the obstacle, whereupon it continues its leisurely wandering as before.

Sometimes at the water's edge or in the shallows such a leap will land the animal in the water with a splash that can be heard for some distance; but this does not seem to disturb it, or any other deer that may be feeding near by along the same shore. These other deer will invariably raise their heads at hearing a splash of this sort, but seem quick to discern its harmless nature.

In general, when two or more deer are in proximity, each seems well aware of the presence of the other. When a new individual approaches through the brush or along the same shore, or even appears on the opposite shore, the circumstance immediately interests the other deer. The sound they hear or the detected movement in the brush holds their attention for some little time unless the new arrival comes quickly into plain sight. As soon as one of the group has convinced itself that the intruder is of their own kind, it will

usually lower its head again and go on feeding as before. Frequently while watching one deer we have become aware of the presence of another in the vicinity by watching the behavior of the first. If the animal we are watching raises its head and looks intently in one direction it usually means that some sound or movement has caught its attention. Usually a close watch will reveal another deer in the direction indicated.

While a deer thus leisurely wanders about, its tail is usually held flat against the body; both tail and ears show little action unless the flies are bothersome. In that case these appendages are kept in nervous activity, and the animal may occasionally break into a trot for a few paces in its effort to evade the troublesome pests. Every little while, on the feeding grounds, the deer will lift its head and look about or sniff the wind. This watchfulness is particularly true of the bucks, which seem never to take many steps nor to feed for more than a few moments at a time before raising the head high and gazing about in a suspicious manner. An individual may at such times look intently in some particular direction for some moments. Perhaps a slight sound has caught its ear, but usually a few seconds of close attention will satisfy the animal, whereupon it wags its tail a few times, as much as to say, "all's well", and goes on feeding.

In their leisurely undisturbed feeding periods the deer may wander in the shore mud and nibble at various food plants here met with, or they may wade in the water and feed on plants below the surface. In the latter case frequently the whole head will be submerged. Sometimes, too, the muzzle will be thrust into the mud, when perhaps the animal is in search also for certain roots. As described elsewhere, earlier in the season the animals may feed on *Spirogyra* and other algae.

In wading, the animal usually lifts its feet high at each step, apparently without effort. Occasionally the forefeet may sink into an unseen hole, and the animal thereupon lurches backward and with some effort extricates itself from the trap, only to proceed in another direction as though nothing had happened. Now and then a submerged branch or tree trunk in its path will necessitate a deliberate leap. On one occasion, at Flatfish Pond, a doe was seen to step on the end of a stick so that it flew up and came down on the water with a splash. This caused the animal only a momentary surprise.

When feeding on a shore a deer is inclined to nibble a little here and a little there as it moves along, but if wading deep and feeding



Fig. 152. Woods on the west shore of T-Lake. A runway passes close to the hemlock tree in the middle distance.



Fig. 153. A runway through the ferns near Antedeluvian Pond outlet. August 30, 1929.



Fig. 154. Grassy swamp near Otter Pond stream. A runway leads into the distance, just to the right of the hat. August 12, 1929.



Fig. 155. Region of "The Slang." A runway through the laurels along the side of a knoll in the swamp. Runway is quite distinct to left of hat. July 20, 1929.

on the aquatic vegetation it is likely to stand in one place for a longer time, reaching out in all directions, before moving on. When wandering about the feeding ground whether on shore or in water, it is apparently disinclined to turn back and retrace its steps on account of any obstacle that may be encountered in its path. When the shore ends at an abrupt headland, the animal will sometimes hesitate as though pondering the possibility of swimming around the point, but will usually end by going inland and up over the ridge. It very seldom turns around and feeds back over the same section of shore where it has just passed. In going up a steep ridge the deer may break into a series of leaps. This is perhaps one of the relatively few instances where an undisturbed deer in summer will run, excepting young animals at play.

Many times during our field work the deer were observed to lick themselves. Sometimes this licking merely involved the back and sides, very much as a cow might throw her head back to one side or the other. The deer, however, is very supple and can reach even the base of its tail without undue effort. A buck at Lizard Lake, near Piseco, on July 30, 1928, was seen to lick the whole length of its tail from base to tip. Another buck observed in the pasture at Piseco, a week before, was seen to lift one fore-leg, bend its head under it, reach back and lick between its hind legs. Then again it lifted a fore-leg, keeping it straight, and rubbed the side of its face on the inner surface of this leg. A buck at "L. D." Lake, July 31, frequently lifted one hind foot and scratched its nose with it. Sometimes when thus scratching its nose the foot is moved up and down as though actuated by a spring.

These few examples illustrate the remarkable suppleness of the deer as well as an ability to balance on its feet.

Besides wandering along the shores in search of food plants there found, in early summer the deer are accustomed to wade out into the mud and water in search of aquatic vegetation. The animal, ordinarily appearing as very cleanly in its habits, does not hesitate to wade out into a mud-flat where it sinks a foot or more into the thick ooze, for aquatic plants that may tempt it.

In deeper water, where it is obliged to swim, it snatches floating plants such as lily pads, as it passes them. As it approaches one of these lily pads, for example, it reaches to one side to seize it, but often fails on the first attempt; whereupon it swims around the pad until it gets a firm hold on it. Then with a backward jerk of the head the pad is secured and quickly chewed and swallowed while the animal continues to swim. Another and another pad is secured in the

same way, with the result that when the deer is in such a bed of lily pads it swims in and out in an intricate fashion and may continue to criss-cross a limited area for as much as an hour. Then it may return to shore rather suddenly, look about a little and wander off into the brush, or perhaps loiter a while in a sunny spot just inside the edge of the woods.

An excellent situation in which to observe this behavior was in "The Slang", or the outlet of Little Tupper Lake (Fig. 111). In this shallow sluggish stream lily pads and other aquatic plants abounded, and during much of July, especially, deer were continually seen feeding and swimming there in the early morning and late afternoon. However, by the first of August the animals had practically ceased to come to this foraging place, only an occasional straggler being seen thereafter. No doubt the lily pads had by now become less succulent, and food plants in the woods more attractive.

In several instances at T-Lake, deer were seen swimming in groups of three or four out into the deeper parts of the lake. Usually a buck led the group which seemed to swim about aimlessly for a few minutes, then returned to shore. Possibly the animals resort to this swimming as a means of washing off the mud that has accumulated on their legs while wading.

In the summer, as well known, the deer swims low in the water, only the head and a part of the back showing.

Frequently on emerging from the water deer were seen to shake themselves. At times they shook their heads apparently to get the water out of their ears.

A deer will also swim sometimes for the purpose merely of crossing a lake or a stream lying across its line of travel or separating the animal from its destination. A six-point buck at Round Lake, for example, was seen to swim to an island, from the south shore, landing and entering the brush. On another occasion it was seen to enter the water from the north shore of the wide inlet bay and swim across to the south shore, a considerable distance. It evidently meant but a change of residence within its home locality.

On the loitering grounds deer sometimes stand around for longer or shorter periods, apparently for the purpose of warming themselves in the sun on a chilly morning, or after a swim. At such times the animals usually chew the cud busily, eying meanwhile any objects of the surroundings that happen to catch their attention. In the course of a quarter of an hour or so an individual deer may have looked intently in all directions, perhaps examined every fluttering leaf or other thing of suspicion in its immediate vicinity and given heed as

well to every noise in the neighborhood. No part of its surroundings escapes its alert yet leisurely inspection. No doubt at such a time the approach of some strange object will be detected a long way off. Occasionally we have seen an individual while thus loitering, turn and face in another direction for a while; but usually it will stand in its tracks for some time, then wander off to feed again, or, more likely, lie down on some level spot near by. On the hay meadows on a cool morning the loitering may be followed by an hour or so of resumed feeding, whereupon the deer wanders off into the brush. Along the shores, also, we have seen deer now and then lie down near the place where they have been standing and chewing the cud. Occasionally, while thus standing, the animal will turn and lick its sides, or perhaps lift a front leg and lick the inner side of it. The bucks in particular at such times seem to lick the tail a good deal.

On the bed spot the deer lies down in typical ruminant fashion, dropping on its "knees" first (Fig. 166), then letting the hind quarters down more heavily. The legs are folded up and the animal in general rests on one side, with head up (Fig. 114), like a cow. If there is some central point of interest in the surroundings the animal is likely to face in that direction. A buck seen to lie down near the shore of Robinson Pond, one afternoon, was facing the pond, where occasionally another deer could be seen feeding. A doe that lay down near the edge of the woods, one evening, at Ten-Mile Mark House, faced the buildings, as well as the road where some men at the time were more or less noisily engaged around a stalled automobile. A small three-point buck, previously mentioned, that lay down near a tote road close to the observer, was faced away from the road which, however, was so grown over with bushes as to present no particular outlook to the animal. This deer soon caught the observer's scent and left in haste.

In rising from its bed the deer likewise follows the bovine habit, lifting the hind quarters first, then the fore quarters. In view of this fact it is rather surprising how quickly it can rise to its feet when startled.

Defecation and urination. The characteristics of deer manure have been discussed in another part of this bulletin. The animals may drop excrement almost anywhere, at any time, and apparently without stopping other activity.

In voiding urine, on the other hand, the deer usually assumes a typical position, spreading the hind legs sidewise and extending them backward somewhat, in the case of the bucks, and more forward under the body in the case of the does. The difference in attitude in

the sexes is not, however, very definite. A buck that on one occasion wandered to within about 12 feet of one of the authors, near Slim Pond, urinated a little at a time without assuming any particular attitude. But usually the full bladder is emptied quickly, and all other activity ceases for the moment. Typically the hind quarters are lowered somewhat, the tail vibrates up and down and the ears are directed backward during the process. In observing yearlings or fawns at a distance the attitude assumed by the animals while urinating is sometimes the only clue to their sex.

Disturbed behavior. The alertness of a deer in its native haunts is well known, although the observer who succeeds in stalking one on the feeding grounds may be impressed at first with the apparent unconcern of the animal as it wanders about. It is perhaps on the feeding grounds that deer appear the least suspicious. As a resident of the Adirondacks once expressed it, "when they think no one is around, the animals look very dopey". No doubt this is because the deer at this time is occupied with the task of finding food by means of sight chiefly. It wanders through the woods or along the shore, with the head low, looking this way and that at the vegetation near at hand. Perhaps the nose, too, may be aiding in the search at such times, while the chief sense organs on the alert for danger are the ears. The ears are never at rest; and the woods normally is quiet, with relatively few sounds and these of a kind which the deer recognizes as familiar and harmless. There is good reason to believe that the animal gives no heed to the movements of squirrels, birds, etc., which are a normal part of the environment. Frequently we have noted that an occasional outburst of blue jays or the hammering of a pileated woodpecker, the cry of a gull or the splash of a duck taking flight from the water of a bay, are not noticed by the deer. On August 12, for instance, at Loon Pond near Little Tupper Lake, the senior author was watching a large eight-point buck that wandered near him on the shore. It caught sight of a slight movement on his part, raised its head and gazed at him intently, tense and ready for instant flight. While both stood motionless and watched each other in this fashion a few ducks suddenly arose from the near-by lake, with considerable splashing. One would have expected the animal, in the circumstances, to be startled by this commotion, but so far as outward signs indicated it paid no attention to the sound, not even turning its head in that direction. At the end of its period of scrutiny, the human object remaining motionless, the animal evidently decided that it was harmless, and went on feeding. The splashing of the ducks was doubtless a familiar sound.



Fig. 156. A runway among the laurels and alders at the outlet from T-Lake. The tracks pass between the hat and the small tree at the left.



Fig. 157. North shore of Stony Pond; a sandy bottomed shore, used as a runway by deer that waded along and fed on shore bushes. July 15, 1929.



Fig. 158. A sand spit near Vly Lake. In the left foreground may be seen tracks of a raccoon. Beyond the hat are tracks of two deer leading into the middle distance.



Fig. 159. Another view of the sand spit near Vly Lake, showing numerous deer tracks.

On the other hand the alarm cry of some mammal or bird may, perhaps, serve as a warning to the deer. On July 29, while the senior author was watching deer at Lower Cat Pond, he was discovered by a flock of blue jays, which broke forth with their characteristic cries overhead. The deer he was watching appeared to become attentive and somewhat suspicious at the outburst, but soon relaxed and went on feeding. On another occasion, July 15, at Stony Pond, it was thought that gulls overhead had, on discovering him, made so much noise that the deer in view were more wary than usual. As a general thing such disturbances by other animals seem merely to cause the deer to assume an attitude of alertness and if it does not see any cause for the disturbance it will go on feeding. However, at such a time a slight motion detected in the woods, or the snap of a twig, is likely to start the animal away on the run. And when a deer looks up and inspects its surroundings a surprisingly slight movement will catch its eye.

An important characteristic of the deer, as before mentioned, is its curiosity. When startled suddenly by some disturbance which, however, does not increase its alarm, it will invariably stop at a little distance and look back before slipping away into deeper cover. Several cases were noted where the evidence indicated that the animals, when out of sight, would circle to get another look at the strange object from a different angle. Conversations with guides indicated that in the winter this same habit is frequently evidenced by the tracks in the snow.

At T-Lake camp we found tracks in the muddy trail near by that indicated that a deer had been watching our camp-fire at night from a distance of about seventy yards. At this place and also at White Birch Lake a deer was heard to "blow" close to camp, in the early dawn. No doubt the curiosity of these animals had been excited by the unusual sights and smells about the camp.

In general, yearlings are much less likely to be alarmed by human beings than are the older animals, and does less than bucks. A yearling at T-Lake, one morning, after apparently scenting the observer, nevertheless came forward again and passed rather close to the lookout point where he was concealed. At Jessup Lake one came within about thirty feet of the observer, hesitated, drew back a few steps and peered out from under an overhanging branch; came forward again and then leaped back and into the woods, with tail erect. It may be assumed that these yearlings had not yet acquired much fear of man.

The eye or rather the brain of a deer does not seem to recognize

a human being as a thing of danger unless he moves. Many times on a trail, for example, if a person suddenly finds himself close to a deer he may escape notice by the animal if he "freezes" or stands motionless. If the deer has noticed his last movement and raised its head to look at him, he may need to stand thus perfectly motionless for what may seem an interminable period if he is not to alarm the animal further. If he has the patience to do this the deer may eventually go on feeding again, with an occasional glance towards the strange object. But the least motion now, or the faintest of scent carried by the breeze, will send the animal crashing into the brush. However, on one occasion, August 17, near Ten-Mile Mark, the senior author watched a buck which seemed, to some extent, to recognize him as a thing to be feared without his making any movement. He had succeeded in sneaking up to within about twenty-five feet of the animal which was lying down. It must either have scented him, or heard him, for it got up and looked all around. The instant it looked in his direction though he had not moved, it turned and dashed into the woods. It apparently recognized that the strange object was foreign to its immediate surroundings.

Doubtless the sense of smell is very acute in the deer, as perhaps every man will certify who has still-hunted. On August 19, good proof of this was seen. The senior author had passed quietly along the tote road that circles around the south end of Robinson Pond, near Little Tupper Lake, and had paused to focus his glass on a yearling deer. Chancing to look back over the way he had come he saw a six-point buck emerging leisurely into the road less than a hundred yards away and where he had just passed. Evidently the animal had not heard him, for its head was down and it was wandering about in search of food. As it lowered its nose to the trail it suddenly started back, then cautiously sniffed at the road before going on into the brush on the other side. An occasional snap of a twig could be heard as it moved on down to the shore, unalarmed. Its sensitive nose had caught the scent in the trail where the man had passed, but evidently this stimulus was not of a kind to frighten it greatly. It is probably less surprising that a deer is capable of detecting the fresh trail of a member of its own kind or of some other species by the scent.

Anyone who observes deer will soon be impressed by its alertness and keen senses. The bucks seem more nervous in disposition, on the average, than do the does. They keep a continual lookout over the neighborhood while feeding, and each unusual sound, sight or scent must be studied intently. The does in contrast are less alert and will feed for longer periods without looking up and about them.

The slightest sound, such as the snap of a twig or the rustle of leaves underfoot, will usually put a deer on the alert (Fig. 109), for the moment at least. The same is true with regard to a scent that is new or strange to it. Its nose is, perhaps, the deer's chief reliance in detecting danger, and usually a faint disturbing scent is enough to send the animal bounding into the woods. An instance of this was seen on August 15, 1927, at "L. D." Lake, near Piseco. A doe was sighted about one hundred yards away on a mud-flat, where it was feeding. The observer sneaked toward it and into view without being noticed, moving forward each time the doe lowered its head and remaining motionless when it looked up. It was approaching, and the breeze was at right angles to its advance, but when a sudden shifting gust carried the scent to the deer, the animal immediately took alarm and disappeared into the brush.

When a little group of deer along a shore is startled, they all dash quickly into the woods, with perhaps a good deal of blowing and squawking; then all is quiet for a few minutes after which the does, at least, begin to reappear one by one, to continue feeding. Usually the bucks, when startled thus, will not return to the shore so soon, if at all.

There is little doubt, probably, that the deer has an unusually keen sense of hearing and of smell; and it will also quickly see a moving object, but a stationary object may go entirely unnoticed. Many times, during the present field work, the authors had opportunity to observe this by "freezing" or remaining motionless immediately upon sighting a deer, and on such occasions the animal frequently went on feeding without noticing the intruder, although he might be well within its range of vision.

Upon the least sign of something unusual in the immediate vicinity, whether the snap of a twig, a slight movement in the bushes or, perhaps, an unfamiliar smell, a deer will instantly raise its head and watch intently in the direction of the disturbance. In the case of a scent it may turn its head this way and that, and perhaps change its position or move about more or less, with head up, testing the wind. — At such times the ears are pointed forward, nostrils dilated, and the whole animal tense and alert, ready for action. But if there is no further disturbance it will usually give a sideways wag of its tail, lower its head and go on feeding.

On the other hand, if a further stimulus reaches the animal or a strange object is in sight it may have its curiosity still more aroused and may then advance toward the object with slow deliberate steps, lifting the front feet rather high and stamping with each downward

step. This is particularly characteristic of the bucks, and perhaps is a type of behavior correlated with his fighting nature at certain seasons. Usually the animal will advance thus only a few steps, when apparently some sudden stimulus reaches it, causing it to turn and bound away into the brush, emitting several snorts.

At such times it seems as though the patience of the animal had reached its limit. On several occasions indications of this have been noted. An eight-point buck observed by the senior author at Loon Pond, on August 12, 1929, after alternating periods of watching and feeding came nearer and looked at him intently. Finally, without any movement on the observer's part to startle it, the deer turned and made two or three stiff-legged leaps in retreat, as though the strange object had "got on its nerves". Then it began to feed again and soon wandered out of sight.

Again, a small doe in the meadow near the house at Ten-Mile Mark, on the evening of August 25, 1929, was wandering out toward the buildings when a dog began to bark. The doe turned and bounded back a few yards toward the bushes; then resumed feeding. It was evidently startled but not really frightened by the sound.

On August 25, while sitting on a hillside looking over the burnt grounds north of Sperry Pond, near Little Tupper Lake, one of us suddenly noticed a doe bounding over the bushes some distance away and then trotting into the woods. The circumstances were such that it must have been watching the human intruder some minutes before, perhaps saw him when he was crossing an open valley a few hundred yards away. Other deer seen on the same trip through the burn had behaved in similar manner. They may be said to have shown uneasiness sufficient to take to cover, but showed no actual alarm. At such times the tail may or may not be raised as the animal departs.

The ears and the tail play an important part in registering surprise or alertness in deer. When an individual is on guard, the ears swing forward and back, and the nostrils dilate as the animal strains to catch any odor on the breeze. The tail is usually down when the animal is at ease or feeding, and more actively wagged about if it is on the alert. As stated above, the animal, following a slight disturbance, usually wags its tail once or twice before lowering the head for further feeding. This motion as before suggested, may well be called an "all's well" signal. When the animal is wading this signal is rather suppressed and tail held close; but when it is startled, its tail is immediately raised as the animal bounds away to cover. If, however, the animal is not much frightened the tail often is merely swung from side to side with each bound.



Fig. 160. Outlet from T-Lake. The muddy flats are here overgrown with dense stands of laurels, alders, etc. Deer tracks were numerous along the opposite shore.



Fig. 161. Another view of the mud flat and low woods along west shore of T-Lake.



Fig. 162. West shore of T-Lake, as seen from the observation blind on the east shore. A favorite feeding ground for deer in early summer was the section of swampy shore at the left center of the picture.



Fig. 163. Submerged bushes along the west shore of T-Lake. A favorite feeding spot for deer during late June and July.

The mode of leaping of the deer is, naturally, dependent somewhat on the character of the terrain as well as on the degree of alarm. In open smooth country the jumps are likely to be regular and in a direct line; their length depending on the degree of fright. In low brush, as in burned-over areas or in the sweet gale bogs, the leaps are likely to be higher, slower and in a zig-zag course, as the animal chooses each landing place ahead. This is true even though the animal is considerably startled. No doubt this changing, dodging course is, incidentally, to some extent a protection from the hunters' bullets, but the real reason for it is evidently to pick its course. When badly frightened in the woods, the zig-zag course is somewhat less noticeable and the deer crashes through the brush for a few rods in a way that one might think would lead to frequent accidents. If startled in the water it leaps toward the shore; if in the open meadow it runs toward the nearest edge of the woods; and if in the woods it runs from the disturbance, to a little distance. Normally a deer will stop and look back after thus retreating a short ways. It may turn at the edge of the nearest cover, or a few rods away in the woods; but if the disturbance is not repeated, the animal will almost surely turn and look back before proceeding on its way at a slower pace. In this connection Newsom ('26) states that a running deer may at times be stopped by a sharp whistle or even by the report of a rifle. We are inclined to believe that the deer in question would have stopped and looked back regardless of the sound. It seems to be the normal behavior.

It is seldom that one sees a fleeing deer meet with an accident, as it runs. A stumble, fall, or loss of footing, is, however, not unusual and a few such instances were observed in the course of this investigation. On the morning of July 13, 1929, as the senior author was approaching the bridge over Bog Stream, on the State road, a buck beside the road, ahead of him, took fright and as it started to cross the road its hind feet slipped on the smooth macadam and the animal all but fell flat. Again, on August 13, 1929, a doe wading in the shallows at the west end of Moonshine Pond suddenly became alarmed, and as it bounded away it plunged into a deep hole where it got completely mired for a few minutes. With its hind quarters down in the hole it struggled desperately before it could extricate itself, to run frantically into the woods. The struggle to free itself seemed to have increased its fright and it ran a long distance, its course easily followed by its snorting and the snapping of sticks.

One is frequently impressed by the sure-footedness of a running deer. On one occasion a startled doe was watched as it crossed a

long corduroy bridge in the swamp north of Robinson Pond. It ran at full speed the length of the bridge, yet not once did its hoofs slip on the smooth round logs, which in some places had large cracks between them and a slip here would have meant a broken leg, in all probability.

Not often in its normal Adirondack environment is a deer likely to be surprised at any distance from cover. On the morning of August 12, three deer were observed swimming while feeding on lily pads near the north shore of Little Tupper Lake, between the two bridges. An automobile passing on the road just behind the fringe of bushes bordering the lake, frightened them and they found themselves confronted by a terrifying noise in the direction of the only near-by cover. The animals thereupon, keeping to the shallow water of the lake, ran for a distance of several hundred yards before they turned and entered the woods. But on other occasions along this same roadside we saw individual deer skulk in the narrow fringe of bushes along the lake edge while people passed on the road a few yards beyond.

Voice and other sounds. The voice of the deer is heard only when the animal is startled or is in distress, occasionally also as a sign of curiosity, and at times when the doe is hunting for its fawn. In the last mentioned case the call is described as a low whining sound. In other cases the most typical sound is the so-called "blow", "whistle" or "whew". Generally it has much the sound of a squawk. When startled or alarmed the deer will usually dash into the brush, and in doing so is likely to give vent to a loud blow. If not pursued it may, after the first rush, stop and look back. If the object still puzzles it, the animal becomes seemingly impatient, moves about a little and blows several times. The sound varies a good deal with different deer, and perhaps at different times in the same deer and various descriptive terms have been applied to it. Most Adirondack hunters and guides speak of it as a "whistle", and sometimes this described the sound fairly well. Some call it a "blow" and frequently the nasal character of the sound fully justifies this term. Dr. C. E. Johnson and one or two others with whom we have discussed the matter prefer the term "whew", which is highly descriptive at times. Frequently the term "squawk" could well be applied, for the sound reminds one of the raucous, half-whistling squawk which the small boy produces at times by holding a blade of grass stretched tight between his opposed thumbs and blowing on it. A deer heard near Cold Stream Lake (Piseco area) uttered a sound which was more nearly a bleat. It seems, from our observations in

this connection, that the buck more frequently produces a distinct whistling sound than does the doe. The doe more often seems simply to be exhaling forcefully through her nose. Just how the whistling part of the sound is produced is not clear. The sound is usually repeated several times, by the startled deer, then ceases. No doubt it serves as a warning signal to other deer. A loud whistling call from a big buck can probably be easily heard a distance of half a mile, at least in some situations, and in favorable conditions. Many of our observations indicated that the deer is most likely to "blow" when it has seen a human being but cannot get the scent, and less likely if the case is reversed.

Usually the squawk or blow is emitted while the animal is on the run, is repeated with each leap and punctuated by the foot falls which seem to stop each squawk automatically. At other times the deer may run until it is out of sight in the woods, and then may be heard snorting a number of times as it moves about nervously before retreating further. When the deer is out of sight and at some distance in the woods, attention to the character of the squawk will usually indicate whether the animal is running or standing still. The sound is, apparently, always an indication of nervousness or alarm.

It seems likely that in unpeopled sections deer are much less likely to blow than in territory where human disturbance is common. At T-Lake and along the trail to this lake, in the Piseco region, it was usual, when we startled a deer, to hear it squawk a little. In this section hikers and fishing parties are very numerous during late summer. On the other hand, near Dead Man's Vly, where summer visitors are practically unknown, while we startled deer on several occasions, we never heard them to emit a sound. Again, near Rose Pond, a remote lake in the Brandreth section, deer were frequently heard to squawk; and in the Little Tupper Lake region we found them more quiet than were those about Piseco.

While doing field work in a more populous section of New York, near Oneida Lake, the senior author has occasionally seen deer, but here, also, has never heard them emit a sound. These conflicting observations, if they have any significance, may merely mean that deer in the more populous sections have become more accustomed to seeing and hearing human beings, and therefore do not give expression to their internal state by blowing.

Blind Fawn. On August 16, 1929, the senior author found a blind fawn on Buck Mountain, near Little Tupper Lake, and noted a few points about its behavior. When first seen the fawn was

wandering about in the woods near the top of the mountain, in rather aimless fashion. It would remain in one place, where it would turn around and around for a time, with its head in the air (Fig. 167), obviously sniffing the wind, and with ears pointed forward. Then it would take a few steps and repeat the performance. Occasionally it would nibble at a bush and then resume its erratic circling. Its habit of taking only a few nibbles from a bush before moving on was typical of the behavior of deer in general, on feeding grounds. One would rather have expected a blind animal to feed longer at each plant it was able to find. It avoided tree-trunks and brush very skillfully so long as it was not alarmed. A side-wise movement of the head was characteristic, an idea of which may be had from figure 167, a photograph made in the woods and before the animal had been startled. After watching the fawn for an hour at close range, an attempt was made to capture it, with the help of Mr. Sibley, the fire observer. The animal displayed normal agility and speed of movement, but it ran aimlessly and frequently crashed into obstacles in its path. After a strenuous chase down the mountain side the animal was finally captured and hobbled. As soon as it recovered from exhaustion it struggled violently and uttered a sound that was a distinct "blat" or "baah"; then lay still. This was repeated several times during the hour that it was held captive. It seemed to respond to gentle stroking, bending its neck toward our hands as if to encourage it; but upon the least shifting of our feet on the ground, or at any sound near by, it would become frantic and struggle to escape. The animal was apparently totally blind in both eyes, which showed a typical white or "glassy" color. The eyes seemed also smaller than normal. Aside from this visual defect the fawn seemed normal and was in good condition of flesh. No doubt it was still being nursed by the doe.

SOCIAL HABITS OF THE WHITE-TAILED DEER

The white-tailed deer is to some extent a social animal, though as might be expected from the nature of its habitat in the thickets and swamps, the groups are rather loose and not under present conditions large. The term "herd" can hardly be applied to these groups unless it be at the time of yarding in the winter. Even then the term "band" of deer seems to be a better one.

Social groups among deer. Herds of white-tailed deer are a thing of the past, if in fact they actually existed. But certain hunters (quoted by Seton '27, p. 246) have mentioned bands of as



Fig. 164. "The Slang" and an evergreen-covered knoll. July 20, 1929.



Fig. 165. A typical evergreen-covered knoll in the swamp along "The Slang". Deer had runways around this knoll and in the alder swamp in the background. July 20, 1929.



Fig. 166. Just in front of the buildings in the middle distance may be seen the tame deer in the act of lying down. The animal goes down on his "knees" first, then the hind quarters follow.



Fig. 167. Blind fawn found in woods on Buck Mountain. Note characteristic pose. August 10, 1929.

many as 500 individuals, in parts of the mid-west and on the plains of the southwest.

In the spring of the year, as pointed out elsewhere, the does are rather solitary animals during the period immediately before and after the birth of the young. But from the time the young are old enough to follow their mother the doe and her fawns form what may, perhaps, be termed a small social group. The doe may now at times even be accompanied also by her previous year's offspring, and there may thus be formed a loose group of several deer during the summer season. The bucks, also, at this season may occasionally keep together in twos or threes, though they seem to travel for the most part singly all summer. It is, however, not uncommon, when one is watching at a lake shore from a blind, to find two or more bucks appearing at the feeding grounds at the same time. As Seton ('27, p. 257) says of the spring season, "the melting snow sets all free again. The older bucks go off in twos or threes, leaving the does to go their way also; which they do in small groups, accompanied by their young of the year before."

According to Caton ('81, p. 308), the male fawn follows the mother one year, the female fawn two years, except for a period during the summer months when the new fawns are small. Several deer may feed close together at a favored spot, and later stand around in the vicinity for a time. On one occasion such a group of deer was seen across T-Lake, when some of them seemed to be chasing each other or frolicking while others looked on or were feeding. Later these groups will scatter and wander back into the thicket for the day. At times the deer at a lake shore will, as it were, go in for a swim together. Several times at T-Lake during the summer of 1927, groups of three or four deer were seen to swim out into the lake, circle about for some time and then return to the shore. On two occasions such groups were led by a buck, followed by does. The purpose of such a swim was, perhaps, merely enjoyment, or to refresh themselves; incidentally it served, probably, to wash the mud from the legs of those which had been wading along the shore. Such a swimming party constitutes in effect a loose and temporary social group. It may also be indicative of a tendency to play on the part of the white-tailed deer.

Perhaps the most common kind of group is the family group, that is, a doe accompanied by her fawns of the season and those of the previous season. This group wanders about the locality, feeding together, and no doubt loitering and resting near each other. On July 17, 1929, at Two Island Bay, such a company was seen

to approach the water's edge, consisting of a doe, two yearlings and a fawn. They remained in company as long as they were in view. Again, on July 22, 1929, near the south end of Little Tupper Lake, a doe, a fawn and a yearling were seen keeping company. On Buck Mountain, August 8, a doe, a fawn, and a spike-horn buck were seen together, feeding in the brush. Several times in July a group consisting of a doe and two yearlings, part of the time accompanied by a small three-point buck, was seen feeding together in a meadow near the Ten-Mile Mark. In this case, as in many others, it may be simply a common feeding ground that brings the animals together. However, there is no doubt that a certain bond of family relationship keeps the fawns and yearlings with the doe for two seasons or more.

Bucks apparently do not so commonly accompany the family group in the summer, with the exception of an occasional younger animal. Rather, during this season, the bucks themselves tend to form more or less definite groups of their own. Frequently from two to four of them will be seen under circumstances that make it seem that something besides a common food supply has brought them together. On August 5, two large bucks were seen to come together to the salt lick at Ten-Mile Mark. Inasmuch as bucks were not very often seen in the immediate vicinity of the buildings here, it is probable that these two animals, kept more or less close company, and were ranging through the Bog Stream valley.

July 23, 1929, at the mouth of Antedeluvian Stream, two bucks were seen in close proximity and may have been twins. On August 12, while passing in an automobile along the Sabattis road, we sighted four deer in the clearing, which apparently were all bucks. Two were particularly noted, one of them a large eight-point animal with wide antlers, while the second had a narrower spread. On August 17, we went again to the same clearing, in the early morning, and found three bucks; one with wide antlers, another with narrow, eight-point antlers, the third a spike-horn. They entered the clearing from the west and fed slowly eastward, being in sight for about an hour before they disappeared. During all this time they kept continually within a few yards of each other. On several occasions deer were seen in similar loose groups in the hay meadows along Bog Stream, our observations being made from the lookout tower on Buck Mountain. On August 7, four deer were seen to pass in single file westward toward the edge of the woods. The sex could not be determined at the distance. On another occasion the lookout man at the tower reported having seen as many as nine

deer in one part of the meadow, four or five of them forming a rather compact group. At a little distance a large individual, no doubt a buck, was gazing at the gathering. Here, again, it is probable that these animals represented merely an incidental grouping on a favorite feeding ground.

On a feeding ground such as a shore or a hay meadow, when the food is at its best, the deer may be seen in such groups as described, at their favorite time of day, early morning or evening. At such times both bucks and does may be found present. They come from various directions, singly or in company as described above. In general, each gives some attention to the others, watching intently any new arrival at the brush edge until convinced that it is a deer. An observer at a distance can frequently forecast a new arrival at the feeding grounds by watching the behavior of such individuals as are in view, which, quick to detect the approach of the newcomer, raise their heads and gaze intently in that direction.

The white-tail frequently shows a tendency to playfulness. This is, as might be expected, most noticeable in the fawns. The young animal is given to more or less running about, dodging bushes and frisking this way and that, apparently overflowing with energy. Playfulness is especially noticeable where there happen to be two fawns in the family. Among the older animals, too, playfulness is sometimes exhibited. A good example of this was seen on the morning of June 15, 1927. At 5:30 a. m., in a field near Piseco, three bucks with well-started antlers, apparently young adults, were sighted, quietly feeding in the grass. Presently one of them began to chase one of his companions about the meadow, both of them running or rather bounding in a rather stiff-legged fashion. Soon the third joined in, and the frolic continued for some minutes, one chasing another while the third looked on, etc. Then two of them entered the woods and were lost to sight. The third stood for a time looking for them to reappear, then went on feeding.

In the summer of 1929 an observation was made on two does that exhibited a playful mood. In the afternoon of July 22, on the shore near the south end of Little Tupper Lake, the senior author heard a commotion and looked up to see a doe chasing another into the water, about a hundred yards away. The pursued one stopped and looked back from the shallows, trotted on a little ways, and then turned and gave chase to its pursuer. It also struck out with its foot, the other dodging. A large fawn followed closely but took no part in the play. One of the does was smaller than the other and may have been a yearling or a two-year old. It was decidedly

"frisky" and presently began to jump up and down on all fours, in the shallow water. Its behavior in part reminded one of a kitten with a ball. It finally dashed away after the other doe, which meantime had gone into the woods. For some moments the sound of snapping twigs and movements indicated that the play was continued in the forest whence they had come.

During our field observations we noted a few cases where the bucks displayed hostility toward the does. This usually happened along a shore, when a number of deer were feeding together. On one such occasion at T-Lake, a doe happened to come rather close to a buck. There was a sudden commotion and the doe beat a hasty retreat. Again, at Cold Stream Lake, we saw a buck rear and strike with his fore-feet at a doe that evidently came too near.

Not infrequently, also, it happens on the feeding grounds, that deer that are strangers to each other, chance to meet. We noted several examples of this during the summer of 1929, and almost invariably some antagonism was shown by one or the other of the animals. On the morning of July 11, we saw three does at the salt lick near Ten-Mile Mark. Two of them came by chance rather close to each other, when one seemed about to kick the other which, however, suddenly jumped out of range. On July 17, at Two Island Bay, two does approached from opposite directions until they met. They merely cautiously touched noses, then quickly separated and continued on their respective ways. July 20, at Round Lake, two yearlings were seen to strike at each other once or twice with their fore-feet while swimming. This may, however, have been an act of playfulness inasmuch as the two kept near each other for some time without antagonism. On August 3, at Sperry Pond, two bucks, with six and eight points respectively, had been feeding close to each other in the shallow water. They left the water together, one following the other along a runway. The forward one suddenly turned on its companion which quickly leaped to one side and then took a different course through the brush. On August 8, a buck and another individual, the sex of which could not be determined, were seen to meet, and to part again without any evident show of hostility. The previous day a buck was seen to turn on another which was following it across the meadow, and which then quickly bounded to one side and took another course.

Evidently deer, during the summer season at least, and aside from family relations, do not encourage very close contact with one another.

Perhaps the most noteworthy illustration of what may be termed social life among the deer is the coming together of larger numbers

in yards in the winter, which is discussed in more detail in another section of the bulletin. In winter there are, of course, some apparent advantages in banding together, because a number of deer can more readily keep the paths through the yard or feeding ground open, and in this way the weak are helped more or less by the strong. Opinions seem to differ as to whether the bucks and the does yard together. In the Brandreth and Big Moose sections the residents thought the bands were mixed, while at Piseco guides and game protectors were unanimous in the view that the bucks yard separately from the does. In this connection Seton ('09, p. 109) speaks of the life of the deer after the hunting season, saying, ". . . and now the White-tails—male, female, and young—roam in bands that are larger than at any other time of the year." He implies that both sexes yard together. Newsom ('26, p. 152) says that ". . . bucks may or may not yard with the does." The whole matter of yarding and winter habits of the deer is one that needs further investigation.

RELATION OF DEER TO OTHER ANIMALS

In the region around Piseco a few rather indistinct biotic communities can be distinguished. The mountain sides and the rather extensive stretches of forest between lakes might be called the beech-maple-witch hobble community, naming it from the prominent plants. The trees are mostly beech and maple, with a sprinkling of other forms; shrubs are striped maple and witch hobble, etc; and the low-growing plants include saxifrage, false Solomon's seal, *Clintonia*, starflower, violets, bell-wort, *Oxalis* or wood sorrel, nettles, ferns and mosses. So far as the deer are concerned, the witch hobble in this community is important in that it gives to this entire type of habitat the nature of a tangled thicket and furnishes good skulking or hiding places. When a deer is surprised in such cover a few bounds will take it out of sight of the intruder.

With reference to associated mammals in this section, tracks of raccoon were frequently seen along the trails although this animal perhaps properly belongs closer to the lakes and water-courses. The chipmunk is abundant; mice, short-tailed and long-tailed shrews, the hairy-tailed mole and red squirrels were either seen or trapped, or evidence of their presence (holes) noted. The woodchuck also occurred. A black bear may pass through the territory now and then, as signs indicated, and the ruffed grouse is frequently started.

Along the lake shores occurs a narrower or wider strip of low ground which might in itself be considered a biotic community.

Characteristic trees here are spruce, birch and hemlock. Witch hobble and striped maple occur occasionally, but the more characteristic ground cover consists of a profuse growth of ferns. The ground is frequently of a low rolling or hummocky nature, and covered with a thick mat of wood sorrel. Saxifrage, painted trillium, partridge berry and goldthread occur in more or less abundance. Such an area is frequently crossed by numerous deer runways leading to and from the shore or the mud-flat beyond. Other mammals than the deer which probably belong in this community of the low shore in the summer season are the red squirrel, raccoon, porcupine and the various "mice"; the chipmunk occasionally; and the bear that wanders into the area to tear apart decaying stumps and logs which may contain ant nests and perhaps mouse nests. The beaver cuts his trees along the shore line and lives at the edge of the lake in his hut or burrow. Birds were given no particular attention, but the great blue heron was noted feeding along the shore, and nests of the slate-colored junco were found among the hummocks, in June. Small toads and the second larval stage of the spotted salamander (*Triturus viridescens*) were numerous.

The alder swamp is also a characteristic feature of the Adirondack region. Nearly every lake has somewhere on its shore an area of low wet ground, thickly covered with a tangle of alder bushes, making difficult traveling for man, but offering the deer an ideal place to hide. Deer occasionally seen in these alder patches would leap from one hummock to another and quickly disappear. More often they would not be seen at all, but merely heard "whistling" softly from a safe distance. This habitat evidently provides more or less food for deer in addition to cover.

Another community worthy of brief mention is the open swamp, called a "vly" (variety of vlei). It consists typically of a wide area of low wet ground covered with a growth of tall grass and patches of laurels and other low bushes. In some places the larger vlies take on the nature of a quaking bog, and pitcher-plants and orchids are found. Such a bog is probably not visited much by the deer. The open, more solid vly, such as most of Dead Man's Vly, may, in the summer months, furnish more or less food for the deer. During the late summer of 1928 deer were found to bed in the open grassy portions of such areas.

Certain inter-relations between the deer and other common animals deserve mention. The bear, while belonging primarily in the rocky uplands and raspberry tangles, wanders, like the deer, throughout the forested region. Like the deer also, but more generally, he tears



Fig. 168. Pasture north of Piseco village where deer were commonly seen at dawn and dusk during June. June 11, 1928.



Fig. 169. A pasture edge where a buck fed regularly for several mornings in June, 1927.

apart old stumps and rotten logs. In certain instances the work of the two animals in this regard is hard to distinguish.

The rabbit occupies much of the same territory as the deer. The beaver by damming streams increases the extent of the swamps and the muddy shores where grow various food plants for the white-tail. The porcupine is found nearly everywhere, but especially where hemlock occurs, and in the winter it is said occasionally to furnish, unwittingly, a little food for deer by dropping some of the branches that it cuts from the tree-tops. Both animals like salt and are likely to find any salt lick that may exist in a region. According to Mr. Emerson Nye, of Piseco, deer will avoid a salt lick (Fig. 133) for a few days after a porcupine has visited it.

Birds occasionally bear a slight relation to deer by warning them of the approach of men. During the summer of 1928, one morning, several deer were observed feeding along the west shore of T-Lake when a number of robins set up a clamor a little distance away. Possibly they were harassing a bear as the sounds slowly receded from the shore and died away back in the hills. The deer at the feeding grounds all raised their heads and listened, remaining on the alert for some time, finally taking alarm and splashing ashore. The warning squawk or croak of the great blue heron is sometimes noticed by the feeding deer, as is also the splashing of startled ducks. On July 11, 1928, a doe at T-Lake was observed watching a gull that was circling low over the water, intent on catching a fish. As soon as the bird landed on the water the deer paid no more attention to it, but became attentive again when the bird resumed flight.

In some sections the farmers' dogs are important in their relation to the deer. If not kept tied up they are likely to form the habit of roaming in the woods and pursuing deer. Around Piseco, during the summer of 1928, dog tracks were seen along all the main trails, sometimes as far as four miles into the woods. And dogs were actually seen in the woods twice, in daytime, though they are supposed to run mostly at night. When encountered in the woods such dogs are usually very shy toward men, perhaps because most of the guides and rangers shoot at them when opportunity offers. How much harm they do to the deer is hard to determine. Opinions differ as to whether or not they can overtake and kill an adult deer, but most men we talked with were of the opinion that they can at least kill fawns.

In the pasture at Ten-Mile Mark deer were sometimes seen rather near the cattle at the salt lick. Always, however, they remained apart and kept a close watch on the movements of the cows. A lone cow

elk was also present in this territory, but was given a wide berth by the deer. On the morning of July 11 this elk was lying down near the top of a salt lick knoll, and rather near the chunks of rock salt. Three white-tail does were present, also, and occasionally the one or the other of these would approach cautiously closer to the elk, only to beat a hasty retreat the instant the elk turned its head. On the whole it seemed that deer were more likely to be found at the salt lick when the cattle and the elk were in some other part of the pasture.

Insect pests. Some aspects of the behavior of the deer are attributed by resident people to the torment caused by the flies. Many suppose that the deer come to the lake shores and wade and swim in order to rid themselves of the pests. According to the opinion of one game protector, the animals will wade in muddy water to rid themselves of flies, but not in clear water. Our own observations during the summer of 1929 tend to support a view expressed by various naturalists and other critical observers that it is not flies but food which generally is the chief factor in bringing the deer to the water courses when the question of drink is not concerned. Usually a deer coming to the water will wander along the shore line much of the time, feeding on the shrubbery, or merely wading. Thereupon it may wade farther out and perhaps swim among the lily pads if such are present. This is the usual behavior of an animal leisurely seeking food. We have never in the Adirondack region seen a deer hastily plunge into the water or lie down in the mud for the evident purpose of securing relief from insect pests.

Indeed, on the contrary we have seen cases where deer were obviously being badly pestered by the flies, yet hastened back into the brush rather than into the water. For example, on July 12, at Moonshine Pond the senior author, from a carefully chosen hiding place, kept up a watch for deer between the hours of 10 a.m. and 2 p.m. It was a warm, sultry day and flies were bad. During the period of observation three does came down to the shore at different times. All were obviously greatly bothered by the flies, as shown by the incessant activity of ears and tail, shaking of the head, and a gait approaching a trot. The water along the swampy shore here was shallow, muddy, and would have been a good place for the deer to wallow; yet all three soon retired into the bordering thicket instead of availing themselves of the opportunities presented by either mud or water.

The method and means of the deer for fighting these insect

pests are essentially the same as those of cattle or other familiar hoofed mammals, and consist of switching the tail, flapping the ears, shaking the head, stamping with the feet, swinging the head against the body, etc., etc. We also noted that it can twitch its skin, and impart a tremor to its front legs, at least, sufficient to dislodge the flies.

Despite the annoyance caused by these pests during the height of their season, the deer seem not to suffer loss of flesh or other noticeable ill effects from their attack.

HOME RANGE AND LIFE REGION

An important consideration in the ecology of an animal is the extent of its wanderings. If it stays in one locality continually then it is important to know as much as possible about the environmental conditions there prevailing; and if it migrates at times, to know the reason for this movement. The white-tailed deer is in general a "home range" animal. It apparently does not normally travel over a wide section of territory, although it may be that in pioneer times there were distinct migrations in certain sections. Shiras ('21, p. 133) has pointed out that in a section in northern Michigan, some years ago, deer were known to migrate every spring and fall. Nothing of this sort has been known to occur in recent years. Newsom ('26, p. 11) says of the white-tail that, "excepting the rutting season he is not inclined to roam. With food and water within reach he may stay around for weeks in a circle of a mile or so." According to Seton ('27, p. 252), the home range of a white-tail is "smaller probably than that of any other of the deer family." Audubon and Bachman, according to Seton ('27, p. 252), state that the white-tail ". . . is usually found in the same range or drive, as it is called, and often not fifty yards from the place where it was started before". This seems to be particularly true in the summer time, but in the fall it is probable that in the excitement of the breeding season deer will travel farther. Their feeding habits also vary at this time and lead them into neighboring localities. Newsom ('26, p. 6) mentions their preference at this time for deserted apple orchards, and states that he has several times followed the back track of animals and found that they traveled several miles in search of food. It is likely that the home range of a deer is much more limited in extent during June and early July than at other times during the summer, these being the months when the animals frequent the lake shores and find food abundant within a limited area.

During the course of the present investigation a number of

observations indicated that deer remain within a rather limited area during the summer months. For instance, in 1927 a certain buck was seen once at the south end of Scotch Lake, again on the trail just east of there, and either seen or heard nine times close to the intersection of the trail with the outlet from the lake. On several other occasions along the T-Lake trail deer were started more than once and at approximately the same place, and the same time of day. Sometimes they were seen, sometimes heard blowing or squawking, and sometimes the hoof beats only were heard as the animal hurried away through the brush. It is of course impossible to be sure that it was the same deer seen or heard in each and every instance, but this seems likely in a large number of the cases. The trail was usually taken by the observer at the same time of day, namely at dawn, starting about three-quarters of an hour before daylight. Individual deer were either seen or heard repeatedly at the same place and at the same hour, a fact that is easily explainable if we assume that the same deer were encountered at each place each time.

In several other sections, also, evidence was gained tending to show that deer do not wander far from what is, for the time being, at least, their home locality. During the summer of 1927 two does were repeatedly observed at dusk at a pasture edge at Piseco (see Fig. 168) and an eight-point buck was seen frequently feeding in a meadow near by (Fig. 169). In this region in 1928 two yearlings were seen frequently at White Birch Lake; a ten-point buck was seen three times at Dead Man's Vly, a district not often visited; a six-point buck was seen several times at different periods of the day in the pasture back of the Anibal Hotel; and two does were started several times in late afternoon, in the edge of the woods along the T-Lake trail.

Other observations on the limited home range of the white-tail were recorded from Brandreth and Big Moose during the summer of 1927. Southeast of Little Rapids, near Brandreth, lies a narrow stretch of woods between the flow grounds and the railway tracks. During the six weeks while this section was under observation two bucks and three does ranged over this land, which would measure less than a square mile in area. So far as could be determined these deer did not cross the railway. The same five individuals were to be seen nearly every day during the late afternoon and evening, feeding along the flow grounds.

Another instance is that of the doe and two fawns that came down to the flow grounds opposite the camp at Little Rapids. With considerable regularity in the morning and evening this doe with its

fawns appeared at the water's edge, and the three were also frequently encountered along two old logging roads a short distance from the flow. Evidently they remained in the immediate vicinity the greater part of the time. Other examples are a doe which fed in the set-back near Brandreth station; three does which habitually came down to Thirsty Pond, after six in the evening; a nine-point buck seen on four different occasions around the shores of Safford Pond; and a yearling doe which was started on each of five trips to the beaver ponds on Indian Brook, near Old Forge.

Apparently as long as the food supply in a locality holds out the deer are inclined to stay near by, unless hunted or otherwise disturbed. No doubt dogs running at large in the woods will harass the deer and cause some of them to move to some remoter section. However, in the case of large bucks and does, well able to escape such dogs, it seems likely that if pursued they will circle back and not wander far from their home locality. On June 17, 1928, at noon, a large buck was seen running through the field close to the Anibal Hotel, at Piseco, and across the road and into the woods to the west. It was panting hard and probably had been pursued by dogs which were known to run loose in the neighborhood. Probably it was the same buck seen frequently in the pasture east of the hotel a little later in the season. On this particular day some fishermen on Piseco Lake saw the buck a half hour later, swimming toward the eastern shore. It seems highly probable that, close-pressed by the dogs, it had escaped by running across the open field near the hotel, and later was returning to its home locality by swimming across Piseco Lake. This animal, as mentioned above, stayed in the vicinity of the hotel for some weeks, in spite of the fact that dogs were loose in the neighborhood.

Human disturbance is quite likely to have marked effect on the deer of a locality. During the summer of 1928 we were quite impressed by the fact that on first visiting a lake we would be likely to see more deer than on subsequent days. We were careful in our methods of observation, moving quietly, and up the wind, and secreting ourselves behind bushes or trees when watching the lake for any length of time. However, in spite of such precautions the deer seemed to sense in some way that there were people in the vicinity and almost invariably fewer of the animals would be seen on subsequent days. This led us to adopt the practice of never visiting the same locality two days in succession.

In the T-Lake region and along the trail to T-Lake, the deer seemed to become less numerous at mid-summer. This may have been due to changed food conditions, but is also undoubtedly cor-

related with the appearance of the seasonal "hiking parties", several of which daily make the trip to T-Lake or T-Lake Mountain. These parties are always noisy and no doubt disturb the deer, being, as mentioned elsewhere, to some extent responsible, probably, for the modification of the daily rhythm of the deer in this section.

Doubtless deer change their local ranging grounds at times because of a seasonal change in food plants. An example of this is the coming of deer to certain lake shores (for example, White Birch Lake, near Piseco, in 1928) in summer during the short period when deer grass and algae offer an abundance of food. During this same period we saw no signs of deer at Cold Stream Lake, which agreed with our observations also of the previous season. However, a few weeks later, on July 24, it was noted that a number of deer were feeding on algae at Cold Stream Lake, as many as seven animals being seen there on that day. Evidently they had just begun coming to this lake.

In the Brandreth section another example of change of abode was seen during the summer of 1927. Near Falls Lake as many as 24 deer were seen in one day, July 28, within an area of about thirty acres. They were feeding on the algae in the shallow water. However, by the middle of August only a few individuals remained near this feeding ground. With the drying up of the water most of the animals had moved to some other, probably near-by, section.

The congregation of deer in bands in the yards may be listed as a change in local range. Just how far they may at times move to yarding grounds is a question which we cannot answer. At Piseco the residents seemed to think that during the winter of 1927-1928 the deer in this area had "migrated" several miles eastward to yard along the west branch of the Sacandaga River. This seems doubtful, and the notion is probably based on knowledge of a yard of deer in that section and failure to see many deer in the vicinity of Piseco during the winter. Probably there are fewer deer in the Piseco area than some of the residents think, and when these animals yard in small groups in some remote locality the average resident does not come in contact with them. Hence the theory that they had "migrated".

In general, then, it seems likely that deer may stay in a given locality for several weeks, moving thereafter to more favorable feeding grounds near by, but never wandering very far from the section in which they were born, except, perhaps, in certain exceptional instances. It may be that in former times more extended seasonal movements took place in some sections.

Although we are unaware of any experiment of this kind it may

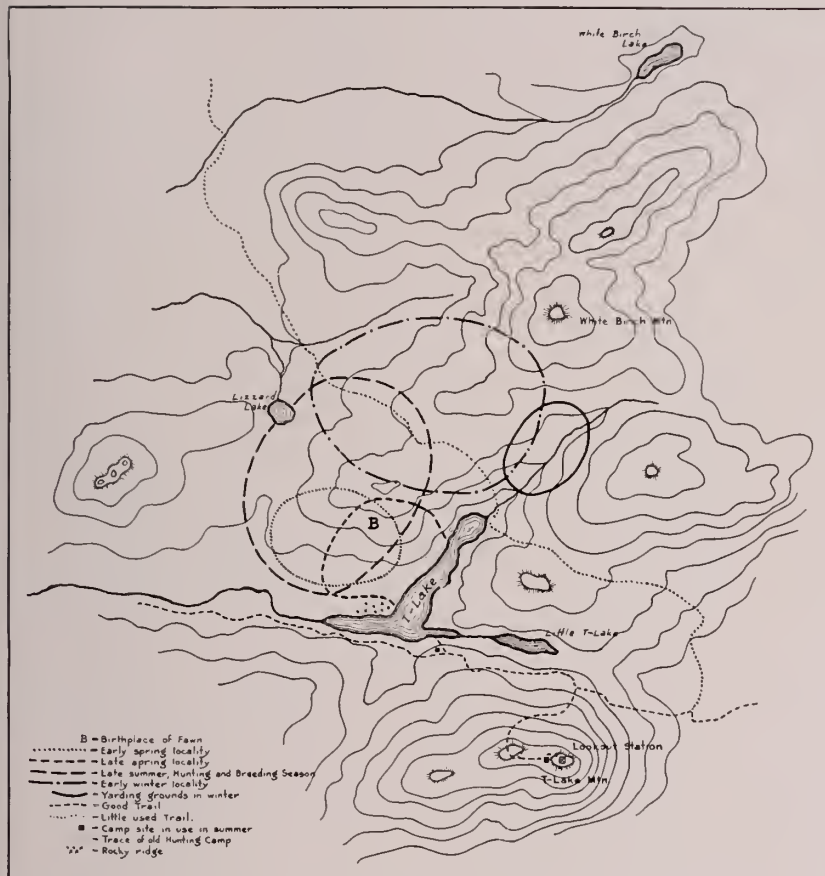
prove possible at some future date to mark a number of deer in some way so that they can be easily recognized, and in that way get more definite information on their wanderings over a given period, perhaps covering the entire year.

From available information it appears that a deer is inclined to stay within a limited area while the food supply is plentiful, and when this dwindles it moves to another locality. Other factors, such as human disturbance, breeding season, etc., of course play a part. Map 7 gives an hypothetical analysis of the yearly range of a doe frequently seen on the western shore of T-Lake. A fawn was seen with her during the summer of 1927. Perhaps the fawn was born at some point as "B" on the map, a quiet, remote thicket on the southern slope of a ridge, where the spring sun would add its warmth. The mother at this season would probably wander over a limited area, as indicated on the map by the dotted line. This area is lowland thicket and semi-swamp, containing a variety of vegetation which would furnish a ready supply of food for the lactating animal. Water would also be readily available in several small brooks.

Later the fawn would begin to travel abroad with the mother, the range of which would very likely change to the area outlined by means of short dashes. This change would be expected because at this early summer season the west shore of T-Lake is a favorite feeding ground. The doe and its fawn would therefore probably be feeding at the shore in early morning and late evening, retiring into the thickets during the middle of the day. As the season advanced this crepuscular rhythm with respect to the lake shore would become more pronounced due to the increasing number of fishermen and outing parties that would be visiting the lake during the day, which are a disturbing factor in the life of the deer in this vicinity.

With the coming of late summer the lake vegetation no longer has so much attraction for the deer, hiking parties are then more noisy and numerous and the animals withdraw from the lake and probably roam more widely in search of scattered items of food. Our doe and fawn might then wander over the area circumscribed by long dashes on the map, including swampy lowland thickets as well as the upland ridges to the north, where nuts and berries probably add to the food. Hiking parties rarely enter this district, but an occasional fisherman takes the longer trail westward to Buck Pond. When autumn comes and hunters enter the woods our deer probably become more wary. In the mating season the now well-grown fawn skulks in some thicket while the doe is pursued by

White-tailed Deer of the Adirondacks



Map 7

the bucks, perhaps in wide circles through the surrounding forest. Occasionally she may become involved in a "drive" when some group of deer hunters comes over the Buck Pond trail and hunts the region to the west of T-Lake.

Early winter may find not only our doe and its fawn, but also other deer of the vicinity gathering in loose groups and probably feeding over such an area as indicated by the dash-and-dot line, including a good deal of upland where mast and coarse browse of one sort or another furnish the principal food. When winter storms drive the animals to seek more sheltered places we may imagine them moving a little more to the east, to known yarding grounds northeast of T-Lake (area surrounded with heavy solid line). In this sheltered valley the band may spend the severer part of the winter.

BIBLIOGRAPHY

- ALLEN, G. M.
1929. History of the Virginia Deer in New England. Paper read at Conference of Mass. Fish and Game Assoc., pp. 19-38. Boston.
- ALLEN, J. A.
1900. Preliminary List of the Mammals of New York. *Amer. Nat.*, Vol. 34, pp. 316-318.
- ALLEN, P.
1885. History of the Expedition under the command of Captains Lewis and Clarke. Vols. 1 and 2. Harper and Brothers, N. Y.
- ANDERSON, R. M.
1924. The Present Status and Future Prospects of the Larger Mammals of Canada. *Scottish Geog. Mag.*, Vol. 40, pp. 321-331. (November)
- ANONYMOUS
1881. The Antlers of Deer. *Forest and Stream*, Vol. 16, No. 21, p. 405. (June 23)
- ANONYMOUS (SIGNED G. R. B.)
1882. Pennsylvania Deer Hunting. *Forest and Stream*, Vol. 19, No. 6, p. 107. (Sept. 7)
- ANONYMOUS
1883. North American Cervidae. Review in *Forest and Stream*, Vol. 21, No. 13, p. 244. (Oct. 25)
- ANTHONY, H. E.
1928. Field Book of North American Mammals. Pp. 1-625. Putnam's Sons, N. Y. and London.
- AUDUBON, J. J., and BACHMAN, J.
1849. The Quadrupeds of North America. Vol. 1, pp. 1-389. New York.
- AVERY, C.
1925. Deer in New York's Back Yard. *Bull. Amer. Game Prot. Assoc.* in *Field and Stream*, June 1925, pp. 36, 38.
1925a. Deer Plentiful in the Catskills. *Bull. Amer. Game Prot. Assoc.* in *Field and Stream*, Oct. 1925, pp. 8-9.
1926. Introducing Deer in Missouri. *Bull. Amer. Game Prot. Assoc.* in *Field and Stream*, Feb. 1926, p. 41.
1926a. Dogs a Menace to Deer. *Bull. Amer. Game Prot. Assoc.* in *Field and Stream*, May 1926, p. 46.
1927. Twenty Thousand Deer Sacrificed. *Bull. Amer. Game Prot. Assoc.* in *Field and Stream*, Feb. 1927, p. 42.
1927a. Slaughter of the Innocents. *Bull. Amer. Game Prot. Assoc.* in *Field and Stream*, Feb. 1927, p. 43.
1927b. Proof that Game does "come back". *Bull. Amer. Game Prot. Assoc.* in *Field and Stream*, Feb. 1927, p. 43.
1927c. Game Survey in New Mexico. *Bull. Amer. Game Prot. Assoc.* in *Field and Stream*, June 1927, pp. 46-47.
1927d. Heavy Deer Kill in Minnesota. *Bull. Amer. Game Prot. Assoc.* in *Field and Stream*, Aug. 1927, p. 42.
1927e. Deer are Dangerous Pets. *Bull. Amer. Game Prot. Assoc.* in *Field and Stream*, Oct. 1927, p. 40.
1927f. A Fawn Nursery. *Bull. Amer. Game Prot. Assoc.* in *Field and Stream*, Dec. 1927, p. 43.
1928. New York's Great Deer Crop. *Bull. Amer. Game Prot. Assoc.* in *Field and Stream*, Mar. 1928, p. 43.
1928a. Pennsylvania to Kill Does and Protect Bucks. *Amer. Game, Bull. Amer. Game Prot. Assoc.* Vol. 17, pp. 55-56, 66-67, July 1928.
1928b. Pennsylvania's Surplus Deer. *Bull. Amer. Game Prot. Assoc.* in *Field and Stream*, Oct. 1928, p. 8.
- "AWAHSOOSE"
1881. Deer in Vermont. *Forest and Stream*, Vol. 17, No. 14, p. 26.

- BAILEY, V.
1905. Biological Survey of Texas. North Amer. Fauna No. 25, U. S. Dept. of Agric. Biol. Survey, pp. 60-65.
- BANGS, O.
1896. The Florida Deer. Proc. Biol. Soc. Washington, Vol. 10, pp. 25-28.
- BARBER, W. E.
1921. The Blood-stained Trail of the White-Tailed Deer in Wisconsin. Wis. Conservationist, Vol. 3, No. 1, pp. 1-2. March, 1921.
1922. Deer still plentiful in Wisconsin. Wis. Conservationist, Vol. 3, No. 6, p. 16. (January)
- BARBOUR, T., and ALLEN, G. M.
1922. The White-Tailed Deer of Eastern United States. Jour. Mammalogy, Vol. 3, No. 2, pp. 65-78.
- BARNABY, W. C.
1920. Whitetail Deer in New Hampshire. Forest and Stream, Vol. 90, No. 11, pp. 581-584; 612-614. (November)
- BISSEL, T.
1922. Hunting with a Barometer. Field and Stream, pp. 654-655. (October)
- BOWMAN, H.
1929. Whose Deer? Field and Stream, pp. 40-41; 112-113. (May)
- BRANDRETH, P.
1929. Deer in Winter. Forest and Stream, Vol. 99, No. 1, pp. 26-27, 70.
- BRAYTON, A. M.
1882. Report on Mammalia of Ohio. Rep. Geol. Surv. Ohio, Vol. 4, Pt. 1, pp. 1-185.
- BROWN, C. E.
1921. Dates of Shedding of Antlers. Jour. Mammalogy, Vol. 2, No. 1, p. 39.
- BRUETTE, W.
1924. Deer in New Jersey. Forest and Stream, Vol. 94, No. 3, p. 149.
1925. Big Game Animals Estimated on 159 National Forests. Forest and Stream, Vol. 95, No. 8, pp. 474-475.
- BRULE, L.
1882. Deer Hunt on the Yellow Medicine. Forest and Stream, Vol. 19, No. 15, pp. 286-287.
- BRYANT, H. C.
1924. A "Mad Stone" from a Deer. Jour. Mammalogy, Vol. 5, No. 3, pp. 200-201.
1924a. The Range of an Individual Deer. Jour. Mammalogy, Vol. 5, No. 3, pp. 201-202.
- BURNHAM, J. B.
1928. The Plimsoll Line in White Cedars. Jour. Mammalogy, Vol. 9, No. 1, pp. 43-77.
- CAHALANE, V. H.
1931. Age Classes of White-tail Bucks killed in Northern Michigan in 1929. Jour. Mammalogy, Vol. 12, No. 3, pp. 285-291.
- CARPENTER, W. S.
1919. Whitetail Deer in New York; a Study of the Operation of the Buck Law. Pp. 1-31. N. Y. State Conserv. Comm. Albany.
- CATON, JOHN D.
1881. The Antelope and Deer of America. Pp. 1-426. Forest and Stream Pub. Co., New York.
- CHAMPLAIN, A. B.
1925. "Butterflies from a Deer's Mouth" explained authoritatively. Forest and Stream, Vol. 95, No. 6, p. 349.
- COLVIN, V.
1874. Report on the Topographical Survey of the Adirondack Wilderness of New York. Pp. 1-306. Albany.
- CORY, C. B.
1912. The Mammals of Illinois and Wisconsin. Publ. Field Mus. Nat. Hist., Zool. Series, Vol. 11, pp. 1-502.

- COUES, E.
1878. (Solid Hoofed Deer.) Bull. U. S. Geol. Surv., Notes Herpet. Dak. Mont. Article 12, pp. 293-294.
- CRABB, E. D.
1922. A Preliminary Note on the Number of Tines in the Antlers of the White-tailed Deer as Correlated with Age. Proc. Oklahoma Acad. Sci., Vol. 2 (Univ. Oklahoma Bull. N. S., No. 247, pp. 12-13.
- DASCH, E.
1881. Deer and Deers' Horns. Forest and Stream, Vol. 15, No. 1, pp. 6-7.
- DIXON, J.
1928. What Deer Eat. Amer. Forest Life, Vol. 34, pp. 143-145.
- FULLER, A. R.
1884. Adirondack Deer Complications. Forest and Stream, Vol. 22, No. 24, pp. 466-467.
1884a. Deer in the Adirondacks. Forest and Stream, Vol. 23, No. 19, p. 367.
- GADOW, H.
1902. The Evolution of Horns and Antlers. Proc. Zool. Soc. London, Vol. 1.
- GLASPIE, A. B.
1927. The Albino Deer of Grand Island. Outdoor America, Vol. 5, No. 11, pp. 52-53.
- GOLDMAN, E. A.
1920. Conserving our Wild Animals and Birds. Yearbook U. S. Dept. Agric., Separate 836, pp. 159-174.
- GREGORY, T.
1929. Camera Trapping in the Snow. Jour. Mammalogy, Vol. 10, No. 2, pp. 142-148.
1930. Deer at Night in the North Woods. Pp. 1-211. C. H. Thomas, Springfield, Ill.
- GRINNELL, G. B.
1925. Hunting and Conservation; the book of the Boone and Crockett Club. Chas. Sheldon, Editor. Yale Univ. Press.
1925a. Old-time Range of Virginia Deer, Moose and Elk. Nat. Hist., Vol. 25, pp. 136-143.
- HARPER, F.
1929. New England's Land Mammals. Nature Magazine, Vol. 13, No. 5, pp. 311-314, 345.
- HODGKINS, D. G.
1924. An Albino Deer. Forest and Stream, Vol. 94, No. 7, p. 414.
- HOLLAND, R. P.
1920. How much does a Wild Deer Weigh? Outer's Recreation, Vol. 62, p. 340.
1922. Shed Horns. Bull. Amer. Game Prot. Assoc. in Field and Stream, Sept. 1922, p. 560.
1923. The Deer, the Dog and the Buck Law. Bull. Amer. Game Prot. Assoc. in Field and Stream, p. 1132. Mar. 1923.
- HOLLISTER, N.
1920. Dates of Shedding of Horns. Jour. Mammalogy, Vol. 1, No. 5, pp. 244-245.
- JOHNSON, C. E.
1927. On the Supposed Relation of Deer to Cedars bordering certain Adirondack Lakes. Jour. Mammalogy, Vol. 8, No. 3, pp. 213-221.
- KAUFMANN, F.
1925. Deer Farming. Amer. Fox and Fur Farmer, Vol. 5, pp. 82-34. (November)
- KELSHAW, W.
1924. The Buck Law. Forest and Stream, Vol. 94, No. 4, p. 218.
- LACKEY, E. S.
1924. Large White-Tail Buck. Forest and Stream, Vol. 94, No. 8, p. 478.

- LAING, H. M.
1924. Packing out your Buck. *Forest and Stream*, Vol. 94, No. 11, pp. 668-669; 687-688.
- LANTZ, D. E.
1908. Deer Farming in the United States. U. S. Dept. Agric. Farmer's Bull. 330, pp. 1-20.
- LEE, K. F.
1929. When Snow Blankets the Allegash. Wintering in the Maine Woods. *Forest and Stream*, Vol. 99, No. 1, pp. 20-21; 57-58.
1929a. In the Allegash Country. *Nat'l. Geog. Magazine*, Vol. 55, No. 4.
- MACDONALD, A.
1924. Thirteenth Annual Report of New York State Conservation Commission. Pp. 1-254. Albany.
- MACEWEN, W.
1920. The Growth and Shedding of the Antler of the Deer. The Historical Phenomena and their Relation to the Growth of Bone. Glasgow: Maclehose, Jackson & Co. pp. 1-17, 1-109. Reviewed in *Jour. Mammalogy*, Vol. 3, No. 1, p. 59.
- MERRIAM, C. H.
1884. Deer in the Adirondacks. *Forest and Stream*, Vol. 22, No. 13, pp. 243-244.
1884a. Deer in Adirondacks (contd.). *Forest and Stream*, Vol. 22, No. 14, pp. 264-265.
1884b. The Vertebrates of the Adirondack Region, Northeastern New York. (Mammalia concluded.) *Trans. Linn. Soc. New York*, Vol. 2, pp. 9-214.
1886. The Mammals of the Adirondack Region. Pp. 1-316. New York.
- MODELL, W., and NOBACK, C. V.
1931. Histogenesis of Bone in the Growing Antler of the Cervidae. *Amer. Jour. Anatomy*, Vol. 49, No. 1, pp. 65-95.
- MOORE, W. H.
1931. Notes on Antler Growth of Cervidae. *Jour. Mammalogy*, Vol. 12, No. 2, pp. 169-170.
- NEWSOM, W. M.
1926. Whitetailed Deer. Pp. 1-288. Chas. Scribner's Sons, N. Y.
1926a. Dope for the Deer Hunter. *Field and Stream*, p. 18. October.
- N. Y. STATE CONSERVATION COMMISSION
1913. Second Annual Report of the Conservation Commission. Pp. 1-297. Albany.
- NOBACK, C. V., and MODELL, W.
1930. Direct Bone Formation in the Antler Tines of two American Cervidae, Virginia Deer (*Odocoileus virginianus*) and Wapiti (*Cervus canadensis*). *Zoologica*, Vol. 11, No. 3, pp. 19-60.
- OLT, A.
1927. Die Perucke des Cervidengeweihs und ihre Bedeutung fur die Krebsforschung. *Ber. Oberhess. Ges. Naturheilk. (N.F.)* 11, 3-7.
- OSBORN, H. F.
1914. "Preservation of the wild animals of North America". In: *American Big Game in its Haunts* (the book of the Boone and Crockett Club), pp. 349-373. New York.
- OSGOOD, W. H.
1922. Whitetailed Deer. *Field Museum Leaflet*, No. 1, p. 10.
- PALMER, T. S.
1922. Game as a National Resource. U. S. Dept. Agric. Bull. 1049, pp. 1-48.
- PENNSYLVANIA BOARD OF GAME COMMISSION
1926. Biennial Report for 1925-26. Pp. 1-63. Harrisburg.
- PENROSE, C. B.
1924. Removal of the Testicle in a Sika Deer followed by Deformity of the Antler on the Opposite Side. *Jour. Mammalogy*, Vol. 5, No. 2, pp. 116-118.

PHILLIPS, J. C.

1920. Skull Measurements in the Northern Virginia Deer. *Jour. Mammalogy*, Vol. 1, No. 3, pp. 130-133.

1930. American Game Mammals and Birds. A catalogue of books, 1582 to 1925. Sport, Natural History, and Conservation. Houghton, Mifflin Co.

PICKETT, L. M.

1920. Raising Deer. *Country Life*, Vol. 37, No. 3, pp. 84, 86, 88, 90. (January)

PULLING, A. V. S.

1926. The Future of our Deer. *Field and Stream*, Jan. 1926, pp. 16, 65.

ROOSEVELT, THEODORE

1904. Hunting Trips of a Ranchman. Chapter 4 "The Deer of the River Bottoms." Pp. 112-136. Review of Reviews Co., N. Y.

1905. Outdoor Pastimes of an American Hunter. Chapter 6. C. Scribner's Sons, N. Y.

ROOSEVELT, THEODORE, AND OTHERS

1903. The Deer Family. Pp. 1-334. Macmillan Co., N. Y.

RUTLEDGE, A.

1920. The Deer of Coastal Islands. *Country Life*, Vol. 37, No. 4, pp. 70, 72, 74, 76. (February)

1925. The Funny Side of Deer Hunting. *Forest and Stream*, Vol. 95, No. 11, pp. 646-648; 691-692.

1927. Certain Great Stags. *Field and Stream*, Oct. 1927, pp. 26-27; 62-66.

1927a. The Horn Architecture of the Whitetail. *Field and Stream*, Dec. 1927, pp. 20-21; 76-77.

SETON, E. T.

1909. Life Histories of Northern Animals. Vol. 1, pp. 1-673; Vol. 2, pp. 674-1267. New York.

1925. On the Study of Scatology. *Jour. Mammalogy*, Vol. 6, No. 1, pp. 47-49.

1927. Lives of Game Animals. Vol. 3, pp. 1-780. Doubleday, Doran and Co., N. Y.

SHELFORD, V. E.

1913. Animal Communities in Temperate America. Pp. 1-362. Univ. of Chicago Press.

SHIRAS, G.

1921. The Wild Life of Lake Superior, Past and Present. *Nat'l. Geog. Mag.*, Vol. 40, pp. 113-204.

SHURTER, J. W.

1883. Deer Hunting in the Adirondacks. *Forest and Stream*, Vol. 20, No. 11, pp. 205-207.

SKINNER, M. P.

1921. Dates of Shedding of Horns in Yellowstone Park. *Jour. Mammalogy*, Vol. 2, No. 2, p. 116.

1921a. Horn Shedding in Yellowstone Park. *Jour. Mammalogy*, Vol. 2, No. 3, pp. 172-173.

1929. White-tailed Deer Formerly in the Yellowstone Park. *Jour. Mammalogy*, Vol. 10, No. 2, pp. 101-115.

SOPER, J. D.

1923. The Mammals of Wellington and Waterloo Counties, Ontario. *Jour. Mammalogy*, Vol. 4, No. 4, pp. 244-252.

STRECKER, J. K.

1927. The Trade in Deer Skins in Early Texas. *Jour. Mammalogy*, Vol. 8, No. 2, pp. 106-110.

"TIRADOR"

1881. Hints on Deer Shooting. *Forest and Stream*, Vol. 16, No. 3, pp. 47-48.

VERDE, M.

1882. The Vermont Deer. *Forest and Stream*, Vol. 19, No. 11, p. 208.

WEAVER, H. O.

1928. The Deer Herd of Washington County, Iowa. *Amer. Field*, Vol. 119, No. 9, p. 204.

WHITNEY, C. M.

1924. Taking Pictures of Moose and Deer. *Nature Magazine*, Vol. 3, pp. 325-331, 376.

WOOD, F. E.

1910. A Study of the Mammals of Champaign County, Illinois. *Bull. Ill. State Lab. Nat. Hist.*, Vol. 8, Art. 5, pp. 501-613.

WOODBURY, J. L.

1925. Maine Deer Change Habitat. *Forest and Stream*, Vol. 95, No. 6, p. 350.

YOUNG, S. P.

1928. Bobcat Kills Deer. *Jour. Mammalogy*, Vol. 9, No. 1, pp. 64-65.

ZIEGENFUSS, H. L.

1882. Piseco and T-Lake Falls. *Forest and Stream*, Vol. 18, No. 3, pp. 44-45.

SOME LATE WINTER AND EARLY SPRING OBSERVATIONS ON THE WHITE-TAILED DEER OF THE ADIRONDACKS

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CONTENTS

	PAGE
Introduction	328
Season of 1930.....	328
Season of 1931.....	339
Deer and water in winter.....	344
Critical periods	347
Accidental death	355
Artificial feeding	359
Food in the deer yard.....	363
Temperature and snowfall.....	367
Suggestions for relief of deer in congested areas.....	371
Some popular notions regarding deer.....	372
Summary	382
References	384

INTRODUCTION

During the three summers just preceding this winter study, Dr. Myron T. Townsend and Mr. M. W. Smith were occupied with the series of studies of deer the report of which makes up the previous pages of this bulletin. It was thought that these studies might be supplemented by some observations on winter conditions affecting deer in the Adirondacks, especially during the critical period of late winter and early spring. This observer, therefore, spent several months each during the seasons of 1930 and 1931 in the central Adirondacks for the purpose of studying conditions which concern the ease or difficulty with which deer get through the winter.

The plan of the work entailed the visiting of numerous deer yards, those which the animals selected themselves and some which were created by the establishment of feeding stations. Dead deer found from time to time were examined for stomach content and dehydration, by opening the internal viscera to ascertain conditions there. Visits were made to outlying or "back country" regions as well as the more convenient areas nearer civilization. Various forest habitats were considered, including virgin forest, lumbered regions, hardwood slopes and conifer swamps.

The work during each season began the middle of February and extended to the first of May. In 1930 the chief work was done on the private lands known as Whitney Park, and in the vicinity of Long Lake. In 1931 these two regions were revisited briefly, and several days each were spent at Tahawus, Schroon River, Bay Pond, and the Moose River country southeast of Inlet.

During the prosecution of the field work which this survey entailed I was guided and advised most kindly by Dr. Charles E. Johnson, Director of the Roosevelt Wild Life Forest Experiment Station, and appreciation is here expressed for his valuable assistance. There were also many people met with in the field whose aid and advice were invaluable, and of these I wish to make acknowledgment of especial favors and kindnesses received from Mr. Frederick A. Potter of Sabattis, Mr. and Mrs. Isaac B. Robinson of Long Lake, and Mr. Gerald A. Kenwell of Inlet.

SEASON OF 1930

I arrived at the Whitney headquarters, Sabattis, on February 11 and remained there until March 15, when I went to Long Lake to remain until May 6.



Fig. 170. Little Tupper Lake, Whitney Park, from Buck Mountain Forest Fire Observatory at Ten-Mile Mark. February 14, 1930.



Fig. 171. Looking north on Whitney Park from the Buck Mountain Tower. Forest in the middle ground is good deer cover. February 14, 1930.



Fig. 172. Buck Mountain at the Ten-Mile Mark, Whitney Park. February 15, 1930.



Fig. 173. White and Scotch pines along the road between Whitney Headquarters and Ten-Mile Mark. Deer which frequented the feeding station at Headquarters used this for cover. February 15, 1930.

During neither of the two seasons I spent in the Adirondacks could the weather be considered normal, for it so happened that two successive extremes were encountered. The winter of 1929-1930, according to old residents, was one of the most open winters in thirty years. There was less snow and less continuous cold, by far, than is usually the case in this region, which, of course, was to the advantage of wild life. Deer were to be found in their summer range during much of the winter and were practically unrestricted in their movements; consequently there was much less "yarding" and smaller numbers were congregated within limited areas. Streams were not so completely frozen over, and frequent thaws throughout the winter probably satisfied any demands for water to drink.

There were, however, occasional days of rather extreme cold, the thermometer on February 17 registering 40° below zero. Yet two days later it had risen to 50° above zero, when there ensued several days of spring-like weather. Even with these extremes in temperature I did not find the deer to be greatly affected, for their physical condition, so far as observed, was good. They had apparently been able to spend much time in the burns where grew an abundance of young saplings for browse, and where the snow was not so deep as elsewhere.

Several localities on the Whitney Park received particular attention (see map 8) in this survey. The first of these was a feeding station in the immediate vicinity of the park headquarters. A substantial shelter had been built with a rack for hay, while just outside was a trough containing a mixture of small grains (Fig. 174). The children at the headquarters derived much enjoyment from carrying food to the deer, and the deer in turn responded with a display of confidence that disappeared in the presence of utter strangers.

A few rods north and west of the feeding station was a thrifty pine plantation, which gave shelter to the deer on stormy days, and toward which they retreated at the approach of strangers (Fig. 173). But they withdrew only a short distance and soon after the visitor had departed they would return to their rack and feed trough. About twenty deer were here fed during the winter.

A second situation of interest was between the Tupper Lake highway and Sperry Pond. Here again was a pine plantation, and a feeding place had been provided by placing alfalfa at different points throughout this pine grove (Fig. 179). The deer here were much more timid than at the first mentioned station, their contact with human beings being less frequent. My estimate was that about thirty deer were cared for at this feeding station. When providing

baled alfalfa for deer some persons make a practice of fastening an entire bale at one spot and letting the animals help themselves. This may be more convenient for the person distributing the fodder, but it results in unequal division of the food to the deer. A better system was practiced by the late George Harrington, watchman at the Ten-Mile Mark, on the Whitney Park, who broke the bale and distributed portions of it at different points (Fig. 191). This enabled more deer to reach the hay at the same time, and prevented larger or stronger individuals from hogging the supply. The only criticism which I would make regarding the feeding at Sperry Pond was that the hay was placed on both sides of the highway, so that the deer crossed back and forth, creating an element of risk to motorists and courting disaster to themselves.

I spent a few days also, in March, at Camp Craig, located about six miles from Little Tupper Lake, and east of Whitney Park headquarters. Here the deer were left to their own resources as the distance was felt to be too great for hauling feed. The forest consisted of a mixture of beech, maple, spruce and hemlock, and in it the deer were able to travel about with some ease, although at the time of my visit the snow was about two feet deep. A severe storm occurred during my stay here, and snow-laden branches of many trees, conifers especially, were bent low and within the reach of deer (Fig. 188). As a result of recent lumbering there was considerable second growth to supply browse as well.

One of the important feeding stations for deer on the Whitney Park was located at the Six-Mile Mark, between the headquarters and the village of Long Lake. My previous criticism regarding the placing of feed on both sides of the highway applies to this station, also, especially since a larger number of deer congregated here. I estimated that about thirty-five or forty deer spent the winter here. The feeding place was located not more than three rods from the highway, on one side of the road; and about ten rods distant on the opposite side. The deer were less timid here and allowed a closer approach. They were to be seen at the feeding place nearer the road at almost any time that one might pass by in an automobile. If one then stopped to watch them they did not retreat very far.

The method of handling the bale here was to cut one of its wires and with it fasten the bale to a tree (Fig. 182). The feeding deer, therefore, as many as could find room, surrounded the bale, which resulted, as before, in much waste of the fodder from trampling; and the younger animals got less than their share.

On March 15 I moved from Whitney Park to Long Lake to spend



Fig. 174. Feeding station for deer at Whitney Headquarters; shed where alfalfa was fed, and trough for mixed corn and oats. March 3, 1930.



Fig. 175. Hay for the deer, Whitney Park. This splendid team and their driver were employed many days during the winter, hauling provender to the half-dozen feeding stations in the park. March 19, 1931.



Fig. 176. Outlet of Little Tupper Lake. Whitney Park. The water here seldom freezes, and then not more than about an inch in thickness. March 14, 1930.



Fig. 177. Swamp seen from the bridge over the outlet of Little Tupper Lake. The ice here rarely becomes strong enough to support the weight of a deer, and numbers of the animals are drowned in winter when crossing the outlet from this swamp. February 14, 1930.

the remainder of the season. In the Long Lake district I found few instances where any effort was made to feed the deer through the winter, but in this region were large areas of State land which had been lumbered so that there was an abundance of second-growth beech, maple and birch to furnish natural sustenance for the deer, provided the animals did not become snowbound.

In the near vicinity of Long Lake deer were especially numerous along Fishing Brook, which throughout much of its course flows through the Finch-Pruyn tract east of Long Lake and Kempshall Mountain. This is a logged-over tract and in the Fishing Brook valley deer feed to a large extent on the bark of small maple and other saplings, which I found bright with new scars made by the peeling (Fig. 202). Along with these, old scars made a year or two before were plainly visible. Scars in various states of discoloration showed that this bark had been consumed at intervals during the present winter.

From Fishing Brook westward to Kempshall Mountain, deer signs continued common, with hobble especially showing marks of much recent browsing. Deer ranged over practically all the mountain slope, near the top of which was a good cover of balsam fir which doubtless also supplied some food, although the chief source of food was found to be mountain ash, on which, according to the ranger, Mr. I. B. Robinson, the deer here habitually feed.

Between the east shore of Long Lake, near the outlet, and Cold River is an extensive burn of some years standing (Fig. 199). While some second-growth timber occurs, it is a more open tract than the burn along Big Brook on Whitney Park and is covered with a rank growth of brakes. During the winter of 1929-1930, which, as before remarked, was quite mild, deer were to be found in this burn throughout the winter. They increased in numbers with the coming of spring and by the middle of April were recorded as plentiful. Men working on the State telephone lines between Plumley's Camp, at the foot of Long Lake, and the Cold River ranger camp, in one day counted eleven deer along the four-mile trail between these two points.

On the east side of Long Lake village, between Shaw's Pond and Burnt Mountain, where some men were cutting and hauling firewood during late winter, deer followed up these activities to browse on the tops of the beech, maple and birch thus brought within their reach.

Mr. John Keller, an early inhabitant of the Town of Long Lake, told me that deer in this region were now much more plentiful than

they were when his father first came here many years ago. At that time wolves and panthers were still common and took their toll of deer. But the chief destructive agency, in Mr. Keller's opinion, was the market hunter. When market hunting finally was banned by legislative act the deer began to increase rapidly. He said, further, that in his youth there was plenty of ground hemlock (American yew) throughout the forest, and not deer enough to keep it in check. At the present time there is little of this growth, and it was his belief that deer were chiefly responsible for its decline. At the present time, during certain seasons of the year, Mr. Keller said, he can, not infrequently, on the open hillside above his residence, see as many as three or four to six deer in a group—a sight which had never greeted his father before him.

With the advance of spring a marked decline is noted in the numbers of deer previously seen in certain places. By the middle of April they are also met with much less commonly along the highways, and they begin to withdraw from the feeding stations, evidently moving into the "back country" for the summer. A few days more of rising temperature and as one wanders through the forest he finds that the animals are now pawing through the melting snow and into the softening mold in search of rootlets (Fig. 203). Tufts of hair are found clinging to the sharp ends of snags, to tree trunks or other rubbing posts, indicating that the winter coat is being shed. Larger tufts soon appear as shedding progresses, and every bedding place is more or less hair-sprinkled.

I spent one day at Nehasane Park, which is rigorously guarded against trespass and on which very few deer are allowed to be taken in the hunting season; hence deer are numerous. They have, furthermore, been fed during the winter at headquarters for a great many years and many of the same animals may be recognized from year to year as they return in the late fall. One old doe which was given the name of "Granny" had, I was told, been returning regularly for over ten years and had become very tame (Fig. 210).

Alfalfa is fed here in racks or shelters placed at intervals along the forest trails near headquarters camp (Fig. 207), while grain troughs are provided near the barns (Fig. 209). The deer have learned also to come to the kitchen door for potato peelings, bread crusts, and other scraps from the table (Fig. 208). As many as seventy-five deer, I was informed, have been carried through the winter at Nehasane. No effort is made to encourage the bucks to frequent the feeding stations, as they have a tendency to drive away the does and the fawns.



Fig. 178. The fence enclosing small cedars set out at Whitney Headquarters was high enough to prevent deer jumping over, but did not deter one from crawling through, as the tracks show. February 14, 1930.



Fig. 179. Plantation of Scotch pine at Sperry Pond, Whitney Park, making good cover for deer and used as a feeding station. March 2, 1931.



Fig. 180. Bog River, near Hamilton-St. Lawrence County line. Such streams are open through the winter, because of their swiftness, so that water is not a problem with deer in this region. March 18, 1930.



Fig. 181. Alders along Bog River, St. Lawrence County. Deer fed on these alders before the ice went out, stripping the bark in places. May 5, 1930.

SEASON OF 1931

The winter of 1929-1930, considered one of the mildest in the Adirondacks in thirty years, was followed the succeeding year (1930-1931) by one of the most severe winters known for this long period. Thus it happened that in the two seasons of these investigations two extremes both in temperature and precipitation were experienced, and the conditions encountered do not, therefore, represent those of average winters.

From four to six feet of snow lay on the ground throughout the winter (Fig. 196), and while the temperature at no time fell to as much as 40° below zero, yet for the first time in many years, it was said, no January or February thaws occurred. Sub-zero temperatures prevailed for a period of almost three months. In December, 1930, there occurred a severe sleet storm, encrusting the trees with ice that remained for a period of ten days or two weeks, but after that, until late in March, only snow fell.

During this difficult winter, the deer became confined within very restricted areas, or yards; as the depth of the snow increased, the food supply in the yards eventually became practically exhausted and the animals had difficulty in getting to new feeding grounds on the hardwood hillsides. Consequently there was much suffering in some districts, where considerable numbers of deer were concentrated.

The itinerary of the present season (1931) began at Speculator in southern Hamilton County where I arrived on February 16. There was much snow at that time and the lakes were ice-locked, although the temperature now was moderate. The snow here was not, however, as deep as I found it later in the northern part of Hamilton County.

It soon was evident that the deer were not traveling so much as they did the winter before. During the drive of seventeen miles from Wells to Speculator there was no deer sign along the road. At the time of my arrival at Speculator, "going" was, by the residents, considered hard for deer, and even for a man on snowshoes. The snow was soft and lay about four feet deep in the forest.

One yard in which a considerable number of deer were concentrated was found a few miles north of Speculator, along the Jessup River. The snow here was between three and four feet deep, so when the deer got out of their beaten trails they could progress only with great difficulty. A stand of spruce afforded the animals shelter, and little pockets under the lower branches furnished beds with some protection from the wind. Many fallen trees lay in this area,

the branches of which were covered with lichens and on these plants the deer had been feeding. The river here had open holes at various points, so that the animals had evidently not lacked water.

Across the Sacandaga River from the Sacandaga public camp was another deer yard, between Wells and Hope. Many deer tracks along the river marked the points where the animals came down to drink. This yard was in an extensive growth of white pine, and contained thickets of blackberry, on the end buds of which deer had been feeding. Alders along the stream had also been browsed in places. Scattered through the yard were some aspens, and the broken top of one such tree had been practically denuded of its bark by the deer.

On February 23 I climbed Hamilton Mountain, near Lake Pleasant, and found deer sign plentiful, the animals evidently having been attracted by an extensive growth of mountain ash found here. They feed on the bark, stripping the smaller branches completely (Fig. 193). On the mountain a number of these trees had been blown down during the winter, thus making the upper and more succulent branches more accessible. I saw hardly a tree of this species that did not show the tooth marks of deer on its bark. A number of the trees had been blown down during the winter, bringing their tops within reach of the hungry animals.

From Speculator I moved to Thendara where three days were spent. There was less snow here than in the mountains farther north, and deer, according to the reports of men who were out in the forest daily, were wintering very well. I found deer in this locality in smaller groups, apparently from three to eight or nine, and doubtless because of these smaller concentrations in their yards food was sufficient to last them through the winter. The actual number of deer in a yard is, however, rather uncertain, as judged by signs alone, for a very few animals using the same paths repeatedly readily create an impression of larger numbers.

At McKeever, a few deer had yarded in a small balsam swamp on the property of Mr. William Green. He thought there were seven, and said when seeking water the animals would go down to the frozen brook and paw through the snow till they reached the ice. During thaws the water would seep into the hole, enabling them to drink. Near Okara Lake was another group of four which had been seen repeatedly by different observers during the winter.

There was considerable complaint from residents in this territory about deer-chasing dogs, especially at times when the snow was deep and traveling difficult.



Fig. 182. Feeding of alfalfa to deer at Six-Mile Mark, Whitney Park. The watchman here stood the bale on end and fastened it to a tree. March 16, 1930.



Fig. 183. Residue of hay at Six-Mile Mark feeding station at the close of winter. April 25, 1931.



Fig. 184. Scotch pine browsed by deer at Sperry Pond, Whitney Park. March 2, 1931.



Fig. 185. Balsam felled by wind and cut up for convenience of deer, at roadside near Sperry Pond. Deer were fed hay a few rods within the forest at this point, but left it untouched until the balsam foliage was all consumed. March 19, 1931.

At the end of February I arrived at Long Lake to revisit a few of the localities examined the year previous in that area as well as in Whitney Park. In these localities I now found more actual yarding than in the previous season, and the deer were confined in more restricted areas. As a consequence the food supply was more limited as to variety. In the Fishing Brook valley, for example, during the previous season the deer had been able to get out of the swamps and on to the hardwood slopes, but now they were confined to the immediate vicinity of the brook. Here the animals were feeding largely on pin cherry,—both buds and bark—which fortunately was abundant. The brook, however, was frozen over, so that no open water was accessible.

A visit to Sperry Pond disclosed that the good work of the late Mr. George Harrington in feeding the deer at this point, was being continued by his successor, Mr. George Bertrand. It was interesting to observe that although there was plenty of hay scattered about, the deer were not eating this food exclusively, but between times nibbled twigs of Scotch pine, maple and pin cherry, and in some instances the cherry bark had been taken, also.

At the Six-Mile Mark Mr. Tom Montroy, the watchman, had fed to the deer 39 bales of alfalfa by the first of March, and he estimated that about 35 or 40 deer came to this station regularly during the winter. Mr. Montroy used the method of scattering the hay in flakes instead of fastening an entire bale to a tree.

At headquarters on the Whitney Park feeding the deer continued after the usual custom. Mrs. Howes, cook at headquarters camp, stated to me that on one occasion she had counted as many as 18 deer at the feeding station.

There was a noticeable difference in the occupancy of the open burns during the second winter. With four feet of snow on the ground these burns were inaccessible to deer.

In the area about the Tahawus Club, near Newcomb, in March, I noted more signs of deer than at any place I had yet visited. There is an abundance of cedar throughout this area and deer eat much of it. The snow here, likewise, was deeper than at any other part of the mountains that I had visited. This area was being logged for pulp wood (Fig. 214), and there is a prevalent local feeling that this cutting of spruce and balsam robs the deer of important wintering grounds.

Deer in this territory were found to be eating cedar foliage, bark and buds of alders, lichen and balsam. The snow evidently had come early enough to cover many water holes to some depth and

prevent their freezing over. The deer had dug down through the snow to several of these holes, the sides of which were, however, so steep that it seemed as if the animals must have had difficulty in reaching the water.

From Tahawus I went to Bay Pond, but was able to spend only one day in this locality. March was now half gone and the break-up of winter was at hand. The game protector in this district reported that deer appeared to have gone "down-hill", as he expressed it, during the last ten days. Efforts at Bay Pond to feed the deer were confined to cutting branches of cedar, balsam and hemlock, which were placed at convenient points. One group of five deer had learned to come regularly each night to the cook house for potato peelings and table scraps. The few open water holes found within the area showed many deer tracks leading to and from them.

This territory was burnt over some twenty-five years ago and it now contained much second-growth of beech, birch, hemlock and balsam. Food for adult deer was therefore plentiful, but fawns of the year, sinking into the soft snow, sometimes have difficulty in reaching even the lower branches, and consequently suffer from the lack of food. The game protector told of finding a fawn buried in loose snow and unable to travel, being in a starving condition. Cedar twigs which he offered to it were eaten eagerly.

The last week of March was spent in the Moose River district, sixteen miles south of Inlet, and an account of the conditions here found will appear under the heading of "Critical Periods".

One day in late April was spent on the State Game Preserve at Raquette Lake, in the company of Mr. Kenwell and the game protector, Mr. Thomas Simmons. The day before our visit four inches of wet snow had fallen, so that now trees were dripping and the ground slushy under foot. By the last of April, it was said, some of the earliest fawns of the season are brought forth, and to these it is therefore possible that such falls of wet snow are more or less of a menace.

DEER AND WATER IN WINTER

There is a diversity of opinion regarding the necessity for deer to obtain water during the winter. Some can not be persuaded that deer are more likely to die from lack of food than from lack of water. It would appear, however, that lack of water may be a serious matter only during periods when there is no snow on the ground and streams and lakes are frozen over. Granting that deer are very similar in water requirements to domestic sheep, it follows



Fig. 186. Fringe of cedars along Mohegan Pond, Whitney Park, showing the line supposedly caused by browsing deer. March 6, 1930.



Fig. 187. A spot where deer in the burn near Big Brook had pawed down through the snow to reach dead vegetation. March 5, 1930.

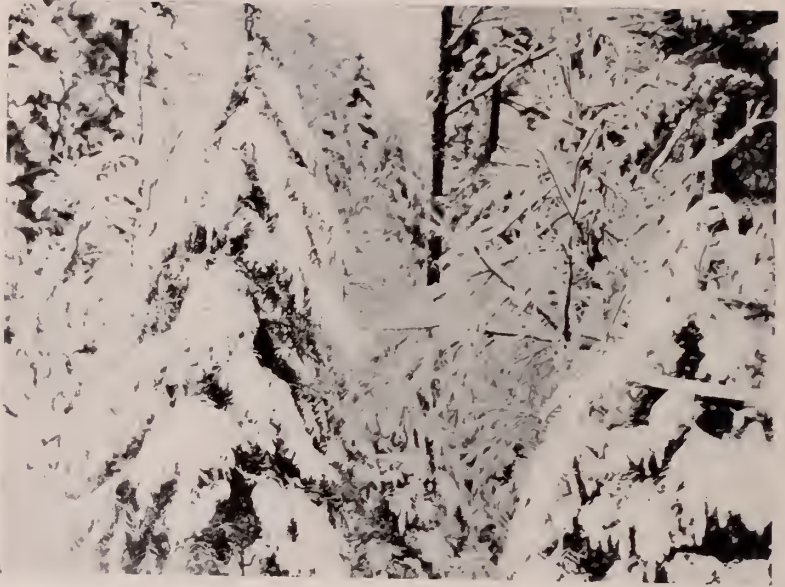


Fig. 188. Balsam and spruce forest near Camp Craig, Whitney Park. A heavy fall of snow makes good cover for deer while it lasts. March 12, 1930.



Fig. 189. Mixed forest after a heavy snowstorm near Flatfish Pond, Whitney Park. March 12, 1930.

that when thirsty they will eat snow, as do sheep; and while I found many persons holding this view I happened to meet with no one who had actually seen the deer in the act of eating snow.

It seems to be true, at times, however, that deer will not eat snow merely as a matter of convenience, for I have often found places where the animals have pawed down through a foot or more of snow in an effort to reach water. In other instances I have seen places where the animals have pawed down to springs that were frozen over, when less than a mile away was a stream that was open in certain swift places the entire winter. The deer in such instance had remained within rather restricted areas and had not wandered widely enough to find the open water. On the other hand, Mr. Joseph Jenkins, game protector at Thendara, stated that he had found deer paths which led to water two or three miles away.

Streams in the deer yards are usually sluggish or of the bog type, so that they freeze over early; and in such instances, when the snow becomes so deep as to prevent the animals from leaving the yards, their need for water can be satisfied only by eating snow.

A factor which in an average Adirondack winter reduced the possibility of deer suffering from any lack of water, is the frequency of thaws, which usually come between the cold snaps. According to the weather reports of the past six years, thaws have occurred at frequent intervals throughout the winter, with the exception of the past winter which was unusually severe as to temperature. On February 17, 1930, the temperature was 40° below zero in the central Adirondacks, and two days later, at two in the afternoon, it was 50° above zero, while pools of water were everywhere. Such extremes within so short a period are, however, unusual.

CRITICAL PERIODS

Severe winter conditions, particularly deep snow, now constitute almost the only important natural enemy of Adirondack deer. Predatory mammals of consequence to big game have long been absent from the Adirondacks; it is possible that disease may appear among the animals at intervals, but there are no records available of any scourge of this sort. Food and protection during critical periods of winter are the paramount problems.

The period of the winter that is most severe on deer begins with the break-up, about the middle or the latter part of March, and extends through the first week, at least, of April, or until the snow has practically disappeared. There are a number of reasons for this.

If the winter has been normal, that is with three or four feet of snow in the mountains, so that yarding has been necessary, the deer will have spent the winter in a spruce and balsam swamp, the slopes leading to which are covered with hardwoods. If the snow has not been too deep so that the deer have been able to maintain paths through the hardwoods, or if the slopes are covered with second-growth hemlock, balsam, birch and maple, the deer have in many cases been able to subsist very well on them. If but a few animals have wintered in a balsam swamp they generally have come through the winter in fair condition as there has been enough food for all.

In some of the remote regions of Hamilton and Essex counties, however, which are seldom penetrated in the hunting season owing to the difficulty of bringing out the carcasses, deer have increased to such an extent that a crowded condition exists. A very good example of this situation may be seen, in the West Canada Lakes region of Hamilton County, where deer are present by the hundreds. Much of the area is State land that has never been lumbered, except for the taking out of white pine a great many years ago; consequently there is no second-growth, on which the deer can feed. The animals crowd into yards along Moose River, Sumner Stream, and various small brooks, where the available food does not last through the winter.

When spring arrives, with thawing days, the deer are greatly weakened by starvation. At this time occur extremes of temperature which during the night may reach almost to zero, and during the day when the sun is shining may rise to 40° or 50° above. We came upon several deer that lay dying, a number of which passed out before our eyes. All the dying deer that we saw were found between nine and eleven in the morning, on east or south slopes bordering the streams, they having evidently sought the sunny spots where the snow had disappeared early. The stomachs of most of the dead deer contained a small amount of balsam, indicating perhaps that balsam alone is not very nourishing food for deer.

I am indebted to Mr. G. A. Kenwell, of Inlet, New York, for much assistance while carrying on my investigations in his vicinity. In his company I covered in three days about six square miles of territory along the South Branch of Moose River (Fig. 223) and along Sumner Stream (Fig. 219 and Map 9). In those three days we found the carcasses of 36 bucks, 34 does and 6 others that had been dead and buried under the snow for so long that positive identification as to sex was not possible. We witnessed the death of a few individuals. Of these 76 deer only 28 were fawns, thus contradict-



Fig. 190. Method of fencing against deer used by watchman at Round Pond, Whitney Park. April 18, 1930.



Fig. 191. Hay scattered for deer at Sperry Pond. Compare with the method used at Six-Mile Mark (Fig. 182). Deer utilize a scattered bale with less waste than if all of it is left in one spot.



Fig. 192. Watering place used by deer on Big Brook, Whitney Park.
March 5, 1930.



Fig. 193. Mountain ash on Hamilton Mountain, on which deer had been
feeding. February 23, 1931.

ing the notion popularly held that most of the deer that perish in winter are fawns. The approximately equal number of both sexes also contradicts the statement often heard that of the adult deer dying in winter, the majority are old does.

Mr. Kenwell has spent his whole life in the Adirondacks and has long been keenly interested in the deer. It has appeared to him, he said, that there is a rather definite order in which deer of a given age and sex die in the course of the winter, which is as follows: the first to be found dead are often the buck fawns, which die early in the winter. There appears to be no good explanation for this. The next to succumb are doe fawns. The early death of many fawns in general may perhaps be attributed to the fact that does are not infrequently killed during the hunting season. Having no dam to depend upon the fawns fail to survive the winter. Next after the death of doe fawns comes that of yearling bucks followed by undersized yearling does. Late in the winter will occur the death of older does, which in many cases have done well to endure so far into the winter. These does in most cases have doubtless had fawns accompanying them to the yarding grounds.

The last to perish are hitherto apparently strong, older bucks. The older bucks probably enter the winter season handicapped by reason of the stress and strain of the breeding season just past, when their vitality has been called upon to the last degree. During this season they wander much in search of does, doubtless neglecting much of the time to feed, so that they are in a run-down condition before the period of distress arrives. In many cases it is perhaps only the extraordinary vitality of the males that carry them through.

The opportunity to observe starving deer will present itself to almost anyone who will go into the woods where the animals congregate in some numbers, and many accounts are heard of personal experiences with suffering deer. As mentioned above the motherless fawns suffer early, and often are found stranded in deep snow, bleating piteously. It appears to be very difficult to save these animals, if they are far gone, by bringing them into a barn to be cared for; at least many persons who had tried it reported failure. It may be well, however, to mention a case in which the artificial care of fawns has been successful.

Mr. Leon Liberty, caretaker at the Tahawus Club in Essex County, has cared for a number of orphaned fawns that had been housed in the barns of the club. During March of the present year (1931) he had a buck and a doe fawn of the preceding season in the barn at the same time, and they were in excellent condition. At

was his intention to liberate them as soon as conditions in the forest permitted. He told me that a fawn that is brought in when in a starving condition often will not eat. The doe fawn which he had at the time of my visit had not been able to get to its feet for two days after it was brought in. He overrides their disinclination to eat by forcing food down their throats. When these young deer are first brought in, bread and milk, oatmeal, and similar easily digestible foods are given. When the animals are able to get to their feet, they are returned to a more natural diet, and cedar branches are cut for them. They always show a fondness for bread and will also eat oats, bran or middlings. Opportunity is given with these captive deer to observe their requirements for water. I have heard it repeatedly said that deer require so little water that they find an ample amount in their food. The fawns under Mr. Liberty's care drank a great deal of water, considering their size, and would sometimes take two or three quarts in twenty-four hours. It is possible, however, that their thirst was increased by the feeding of dry food.

If fawns are not too greatly weakened when found they will often respond to an offer of food immediately. I was told on several occasions by different persons of the finding of fawns in the snow, which would eat cedar and hemlock browse as soon as it was placed before them.

I have mentioned briefly the effect of spring weather conditions on deer, especially the extremes of heat and cold that follow the break-up of winter. While deer weakened by lack of food will doubtless suffer from chill, the fate even of healthy deer that have had ample subsistence through the winter is often in the balance at this time. On the Whitney Park, where the deer had been fed hay throughout the winter, a buck in apparent good health and condition was found lying dead at the feeding station about the middle of April. A veterinarian happened to be visiting the park on professional business when the carcass was brought in. Upon examination he found that the lungs were badly congested, and the condition of the throat and trachea gave evidence of pneumonia.

Another cause of death, to what extent is unknown, that may affect adult does is apparently traceable to the scarcity of food and nourishment. While Mr. Kenwell and I were together we came upon an old doe and two fawns of the preceding summer struggling through the deep snow in a small balsam swamp. The fawns ran off briskly enough, evidence of the good care the doe had given them through the winter, but the doe herself was far from active. In fact, in a very few moments, Mr. Kenwell was able to overtake



Fig. 194. Small stream near Wells, N. Y., showing how some streams have open water in severe weather. February 19, 1931.



Fig. 195. Deer here pawed down through the snow to a frozen puddle, apparently searching for water. February 18, 1931.



Fig. 196. Road between Speculator and Indian Lake, showing the depth of snow at this season. February 18, 1931.



Fig. 197. Looking east from tower on Blue Mountain. The lakes are still frozen-over at this date, April 5, 1930.

her on his snowshoes. After he had held her for photographing (Fig. 220) he liberated her in a well-beaten path through the woods. She trotted off along the path for about three rods, then, coming to a small incline, stopped and looked back at us. Suddenly she collapsed in the path and by the time we reached her she had died. Upon opening her and examining the viscera we found the stomach to contain only a small amount of balsam. But we also found two fetuses which were within four to six weeks of term. Both fetuses had evidently been dead for several days, and mortification had set in. In her weakened condition the doe had not, apparently, had enough nourishment for herself and them too. I have little doubt that a like fate overtakes other does at this season.

ACCIDENTAL DEATH

There are various other factors besides disease and the severity of winter which may bring death to deer at this season. Some of these are merely accidents met with in the forest while others are a result of the encroachment of human beings upon the natural habitat of deer.

The Montreal branch of the New York Central Railroad, entering the mountains at McKeever, passes through the Moose River, Beaver River, and Tupper Lake regions. Deer are frequently caught by the night trains and either killed outright or left in such condition that they have to be killed by the game protectors who may find them. At Nehasane Park I saw an old doe that three years before had been struck by one of the night trains. She had recovered in the main, but her hind legs were left permanently crippled so that she was handicapped more or less in her movements, especially when considerable snow lay on the ground.

During the past winter a number of deer were killed by automobiles along the State road between Long Lake and Tupper Lake. Where the road passes through the Whitney Park more deer lost their lives in this way than by starvation, since deer were being fed along this highway all winter and consequently were more exposed to the traffic.

It may be well to mention again this very questionable practice of feeding deer along highways, which is certain to invite accidents both to deer and automobilists. In some places hay was fed at two points, directly across the road from one another, so that during the night, when the deer were feeding, some individuals were continually crossing and recrossing the road between the two feeding places and thus exposing themselves to oncoming cars.

Another accident to which deer are occasionally exposed in winter is that of drowning. Some of the lake outlets rarely freeze over to any depth and are deceptive in appearance. Such a one, for example, is the outlet to Little Tupper Lake, on the Whitney Park (Figs. 176 and 177). Three deer were drowned in this outlet during the past winter, and possibly a fourth one, although but three carcasses were recovered. I have seen this particular outlet freeze over during a cold night and by noon of the next day be open again. Deer attempting to cross in the morning are therefore liable to break through. Mr. Murray Greenwood, of the Long Lake Club, found a fawn drowned in the Raquette River a short distance below the outlet to Long Lake. The legs of this fawn had been badly lacerated by the rough edge of the ice which it had struggled in vain to surmount. I was told also that in Nehasane Park deer occasionally drown in one of the streams that rarely freezes to any depth.

On the first day of March, 1930, I found a large buck in good condition of flesh lying dead on the ice near the foot of Long Lake (Fig. 200). There had been no snow on the ice, which was glaringly smooth. No mark of violence either by man or beast was to be found on the animal and it appeared clear that the buck had fallen and had not been able to regain its feet. It could have found no footing whatever on the slick ice. It was at some distance from either shore. A few nights before the temperature had been in the neighborhood of 40° below zero, so that even if the animal had fallen late in the evening it would doubtless have frozen to death by morning in this exposed situation.

In a small cedar swamp along the Hudson River where it flows from Sanford Lake I found a fawn that some time before had met with an unusual accident. Its fore legs had been caught between two small cedars which grew close together, apparently from the same root, and formed a V-shaped cleft between them. The snow was here about three feet deep, and the fawn had evidently reared itself against the cedar to browse the foliage. Slipping, its fore legs had slid down into the narrowing cleft (Fig. 216). In its struggles to release itself the legs had worked farther and farther down into the cleft (Fig. 217) so that when I found the carcass the feet were within eight inches of the ground. The carcass had been covered with snow and was partly eaten by foxes.

Mr. Harry Hunt of Cedarlands Park, Long Lake, told me of a deer that had become entangled in a fence on that estate and had died before it was found.



Fig. 198. Cold River near foot of Long Lake, with Seward Range in background. May 2, 1930.



Fig. 199. In the burn along Cold River. Ordinarily considered the summer range of deer, the animals were found here much of the winter of 1929-1930, which was reasonably open. May 2, 1930.



Fig. 200. Dead buck on the ice near the outlet of Long Lake. This deer had been here ten days, during which time there had been a thaw followed by a cold snap. No marks of violence were discernible. Apparently it had fallen on slippery ice, was unable to gain its feet and froze to death. March 1, 1930.



Fig. 201. Witch hobble near the foot of Long Lake. Deer browse extensively on its buds during late winter. April 22, 1931.

ARTIFICIAL FEEDING

By artificial feeding of deer I mean any manner in which food is provided by man. Perhaps the most important and easiest way of providing for deer is by feeding hay and small grain. This is done on practically all the large private areas in the Adirondacks. On the Whitney, Nehasane, and Litchfield parks, and to some extent on the Brandreth Preserve, deer in certain portions of these estates are well cared for. Alfalfa is the chief form of hay fed because it has been found to be utilized with less waste than has any other kind. When fed timothy, deer are likely to eat only the seeded heads and leave the bulk of the straw alone. The animals are also fond of oats, middlings and bran, which are often fed them in a mixture.

There are various methods used on the private parks for issuing food to the deer. In some places small shelters or sheds are built (Fig. 207) and occasionally racks are erected for holding the hay (Fig. 174), but these do not always prevent the feed from being tramped under foot. At one feeding station on Whitney Park one or two fawns were generally not satisfied unless they were in the rack and on top of the hay. In many places the hay was put on a toboggan, hitched behind a car, and taken out and scattered from place to place along the road. It is, however, not safe, as before remarked, to place the hay too near the highway or to feed on two sides of the highway, directly opposite.

In feeding hay when racks are not used, two methods are commonly in practice. One is to break the bale and scatter it through the yard flake by flake (Fig. 191); the other, simply to cut one wire on the bale and fasten the entire bale upright against a tree (Fig. 182). In my opinion the former method is better despite the fact that it entails a little more trouble on the part of the person doing the work. When the entire bale is left in one place a much larger portion is wasted because of concentrated trampling, urination and defecation. Furthermore, the older aggressive bucks are better able to drive the young deer away from the single pile. When the flakes are scattered here and there the hay is consumed more completely, and, more important, when enough places are provided all the deer in the herd have a better chance to get their proper share.

At Whitney Park, where most of my observations on the feeding of hay were made, it was not possible to get an accurate estimate of just how much hay was fed, for domestic stock was fed from the same supply. At the Six-Mile Mark, however, Mr. Montroy,

the custodian, fed over fifty bales during the past winter (1930-1931). About thirty-five deer fed at this point, according to his count. The year previous, Mr. George Harrington, since deceased, told me that a bale scattered at the Sperry Pond feeding station lasted less than three days. There were perhaps a dozen animals feeding at that place.

There are a few other methods of providing food for deer in winter which also might be placed under the head of artificial feeding. It is necessary every spring for forest rangers and observation men to clear the trails along telephone lines and those leading up to the observation towers. Some rangers have noticed that shortly after this work has been begun, deer have followed along, gleaning food from the trimmings. If this work could be done a little earlier in the spring it might be of more benefit to the deer, providing sustenance for them at a time when it is most needed.

Mr. W. G. Howard, of the State Conservation Department, told me that while the department could not authorize the cutting of trees it could advocate the cutting of the lower branches, as high as they could be reached. In many cases, however, I have noticed the lower branches to be within the reach of the animals and yet were seldom touched. When a balsam fir tree, for example, is felled by a storm the tip branches are the first taken, although in time practically all the foliage will be eaten off.

Along most of the mountain streams of any size occur open places, and in some of the swamps are "vlies" or marshy stream borders which are thickly grown with blue-joint grass. When this grass is dead and dry the deer do not eat it, but the experiment has been made of cutting this grass green, salting it a little and curing it. When stacked in this condition deer will eat it to some extent, although I do not believe from accounts that they are really fond of it. Yet, hay cut and preserved in this way and stacked at the edge of a known yarding place might be the means of saving a number of deer. Of course, some sort of fence would be necessary to protect it until it was needed. I have been told by some persons who have tried feeding joint grass, that deer would not eat it; but upon further questioning I found, in some cases, at least, that the hay had been stacked out in the open area where it had been cut. By the time the deer needed it the snow was too deep for the animals to get through to the stacks. Others have made the experiment, with the accessibility in mind, and have found that the deer will eat this hay.

Deer commonly are attracted by lumbering operations, where

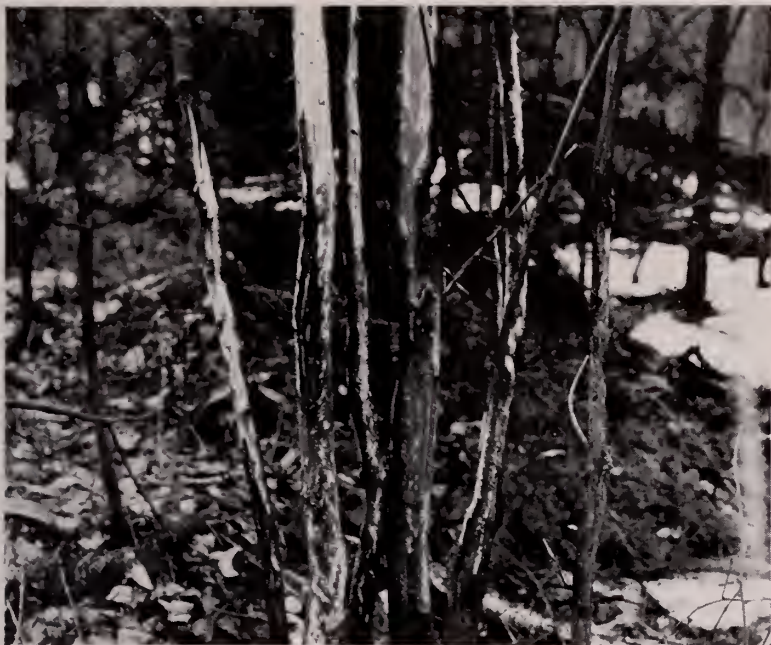


Fig. 202. Maples peeled by deer along Fishing Brook near Long Lake. April 14, 1930.



Fig. 203. Showing where deer had dug down through snow, and surface litter to reach roots. Kempshall Mountain, near Long Lake. April 25, 1930.



Fig. 204. Buttermilk Falls on Raquette River, at the head of Long Lake. There is open water here all winter. April 5, 1930.



Fig. 205. Cedar browsed by deer at Buttermilk Falls, Raquette River. Snow may have protected the foliage near the ground. April 11, 1931.

hardwoods are being cut, and feed on the tops of the felled trees (Fig. 211). In so doing they soon become accustomed to the presence of human beings and show little fear. The trails which the lumbermen make for their own use are quickly taken advantage of by the deer which accordingly are quick to find the slashing where food may be secured.

I met with several camp cooks and housewives in the Adirondacks who found a great deal of enjoyment in providing kitchen scraps for the deer. The animals are very fond of bread-crusts, potato peelings and other waste from the kitchen. The housekeeper at the railway station at Bay Pond placed table scraps at the edge of the porch for the deer all winter, and it was my pleasure one evening when I was there to see seven deer come up through the evening twilight to get their daily rations thus provided. I saw deer also about the kitchen door, after meal-times, at Nehasane Park, where they had become quite tame as a result of such feeding (Fig. 208).

FOOD IN THE DEER YARD

In practically all regions of the Adirondacks, balsam (*Abies balsamea*) is abundant, and this tree furnishes both shelter from the blasts of winter and food in times of scarcity. It is a tree found in moist situations, throughout all the swamps, and in the higher altitudes where sufficient moisture is furnished. Red spruce (*Picea rubra*), the common spruce of the Adirondacks, is found in the lowlands and on the drier slopes and contributes to the deer shelter of the swamp, but rarely is used as food. Many of the swamps contain cedar or arbor vitae (*Thuja occidentalis*) which deer accept readily as food. Many of the slopes about the swamps are covered with beech (*Fagus grandifolia*), maple (*Acer saccharum*), yellow birch (*Betula lutea*) and hemlock (*Tsuga canadensis*).

All the species mentioned above, except spruce, furnish food for deer, the animals feeding more or less on the foliage of the conifers and on the winter buds of the hardwoods. The difficulty in the case of the hardwoods is, however, that through much of the latter part of the winter the snow is so deep that the animals are unable to get out of the swamps and into the hardwood areas.

Of some assistance in inducing the deer to move out from the swamps and onto the hardwood ridges, might be their habit of following trails. If people who range the woods on snowshoes at this season would take the time and trouble of making snowshoe trails from the swamps to the hardwood slopes it is quite probable

that many deer would be induced to follow these trails, which would be improved with use, to better feeding grounds.

Some sort of rill or stream usually drains a swamp, of course, but it is in many cases so small or sluggish that it freezes rapidly or becomes buried so deep under snow that it furnishes no open water for deer. Into the swamps, however, in some places, streams descend from the upper slopes and many of these contain open places during the winter due to the rapidity of their current, although when snow is deep the same difficulty of inaccessibility confronts the animals as in connection with the hardwoods and food. Along practically all good-sized streams there are alder thickets where deer yards of various extents may be found (Fig. 181).

A shrub that is very abundant over practically all the hardwood slopes is witch hobble (*Viburnum alnifolium*) (Fig. 201). The winter buds of this shrub are thick and bulging, and deer usually consume a good deal of this food where accessible.

Perhaps the first choice of coniferous food on the part of deer in winter is cedar when it can be obtained, with hemlock next and balsam last. However, though balsam seems to be least attractive among those mentioned, I believe that they eat a certain amount of it throughout the winter. Being of an oily, resinous nature, it may be more productive of heat than most foods which they obtain. Mr. Joseph Jenkins of Thendara told me of an experiment which he made a few winters ago. An argument had arisen concerning the partiality of deer for various conifers. A quantity of cedar, hemlock and balsam was cut and placed in a pile, the cedar on the bottom, the hemlock covering it, and the balsam on top of the pile. When the deer discovered the pile they dug down through balsam and hemlock to reach the cedar which they consumed first; the hemlock was eaten next and the balsam left till the last.

The lowly and much despised porcupine comes in for his share of credit in providing food for deer in winter. Porcupines, as is well known, eat much hemlock in winter and will spend several days in the top of the same tree without descending. While climbing about in the upper branches they frequently gnaw or break off twigs and small branches of hemlock which drop to the ground. Deer are quick to find this source of food and will often return to the spot daily so long as the porcupine remains in the tree. For example, I found a hemlock near Owl's Head Mountain, near Long Lake, which four or five deer had visited for several days until they had a well-marked trail leading to it from the swamp below.



Fig. 206. Looking across a Long Lake spruce forest to Kempshall Mountain. This mountain provides much mountain ash for deer. March 20, 1930.

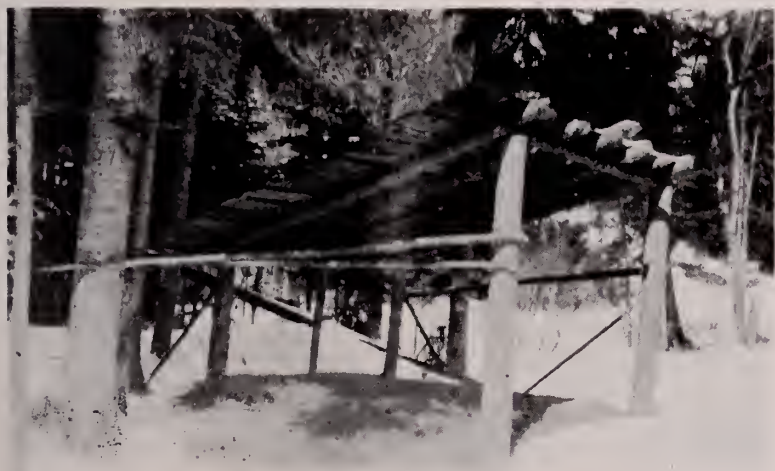


Fig. 207. Type of hay feeding-shed used on the Nehasane Preserve. March 22, 1930.



Fig. 208. Deer come to the kitchen door at Nehasane Park for potato peelings and other refuse from the table. March 22, 1930.



Fig. 209. Grain trough at the Nehasane Park feeding station. March 22, 1930.

Deer are usually able to get around well through a yard during the period of deep snow, since their paths are made and beaten as successive snowfalls come. Hence, even when the snow becomes several feet deep the deer are able to proceed with no great difficulty through the yard.

While a trip through a wintering yard by the casual observer might give the idea that food is plentiful, because of an abundance of balsam or hemlock, yet such is not necessarily the case for the fact is that the animals prefer the upper branches of these trees—probably because these are more tender and succulent—and in many instances will not eat the lower branches except in times of stress. Many of the deer yards have dense stands of spruce, which I have never at any time found them eating. Their disregard of spruce may be noted after a heavy windstorm during which many of these trees are broken off. Balsam, cedar and hemlock are cleaned up in a short time, but spruce will lie on the ground until the needles drop off, untouched by deer.

A heavy wet fall of snow often benefits the deer even though it may interfere with their freedom of movement. Such snow, to a depth of several inches, will often cling to the boughs of conifers, its weight bearing the branches down and causing many of them to break when the first heavy wind springs up, thus placing this additional food within reach of the deer (Fig. 188).

Some artificial deer yards have incidentally been provided by the plantings of Scotch pine in various portions of the Adirondacks (Fig. 173). Such plantations that have reached the age of fifteen or twenty years provide ample shelter for the animals and on occasion, perhaps, some food, for I once found the top of one of these trees lopped off by the wind, the upper branches of which had been stripped of their bark by deer.

TEMPERATURE AND SNOWFALL

Any discussion of deer in connection with deep snow must be linked closely with the matter of their ability to reach food, for the ease with which food may be obtained during the winter depends greatly on the amount of snow and the condition of it, whether it be crusted or soft. To provide an idea of the snowfall in the Adirondacks, the monthly climatological charts of the U. S. Weather Bureau for January, February and March, covering a period of six years past, have been consulted. The Weather Bureau receives reports from a dozen to eighteen different points in the Northern Plateau, which includes the Adirondack Mountains.

The average depth of snow during the past six years has been in January, 32.7 inches; February, 25 inches; and March, 23.9 inches. This, of course, takes in the entire Adirondacks area. The area of deepest snow appears to be that about North Lake and Stillwater Reservoir where a depth of 77 inches was recorded for January, 1926, and 90 inches for March, 1928. There are occasional winters when there is a great extreme, and there are seasons when there is a very light fall of snow. During the spring of 1927 there was a fall of only 6 inches recorded for the month of March, that being the maximum at Lake Placid. There had, however, been much snow in the woods the two preceding months.

If the snow remains soft and yielding it may be quite deep and yet permit the deer to get around in it after a fashion, provided they are not hurried, but after it has reached such a depth that they have to leap through it in order to make progress it is not possible for them to travel far. It is then that the fawns become exhausted and perish, and the adults can easily be overtaken on snowshoes. During such periods the deer remain in the yards and make little or no attempt to move out.

Following a thaw a crust often forms upon the snow with the return of colder weather, which according to its thickness may be either an aid to the deer or a hindrance. If a thick crust be formed it will support the weight of the animals and they will be able to secure food otherwise beyond their reach. The snow crust, however, is seldom thick enough to be generally dependable and a deer in hasty flight may break through with possible injury to its legs.

As to temperatures, these become more important during the latter part of the season, when the spring break-up occurs, for then there is a greater daily fluctuation which has a greater effect on forest life at that time than has the steady cold of the winter. During the past six years a temperature of forty below zero has been reported but once from the Northern Plateau and that was on February 17, 1930, at Stillwater Reservoir. Every winter, however, the temperature drops to 25° or 30° below zero at various points in the Adirondacks area. During an average winter there are frequent thawing spells. In the late winter of 1931, however, the cold was persistent and for the first time in a great many years there was no January or February thaw. Such thawing spells, when they occur, seldom extend beyond four or five days, when the temperature drops again.

The winter of 1929-1930 was exceptional in its mildness in spite of the fact that the lowest temperature in six years was reached



Fig. 210. "Granny" at Nehasane Park. This old doe had been coming to this feeding station for over ten years and became extremely tame. March 22, 1930.



Fig. 211. Deer following lumbermen as they cut the hardwoods browse from the tops of the fallen trees. Brandreth Preserve. February 18, 1930.



Fig. 212. This hemlock had been recumbent for a number of years, but deer came to glean lichen from its dead branches. February 18, 1930.



Fig. 213. Cedars along Courtney Pond near North Hudson. Note that some branches are dead as far as the so-called "deer-line" while others have foliage clear to the water. April 15, 1931.

during that winter. But there was less snowfall, with more thaws, and deer wandered about on their summer range during most of the winter. Very little yarding of the animals was noticeable and certain of the older residents regarded this as the most fortunate winter for deer in thirty years.

The period of greatest mortality to deer occurs generally after March 20, and is occasioned largely by the extremes in temperature for two or three weeks following that date. If the snow has previously been deep and the animals have had to remain in the yards until their supply of food has become exhausted they are in a starving condition by the time the spring weather arrives. At this time the temperature reaches 50° to 60° above zero during the day and at night drops to within ten degrees of zero or lower. These sudden changes of temperature seem to be more than the deer can endure in their run-down condition. The changes are often accompanied by cold rains which chill to the marrow, so that even seemingly healthy individuals which have been cared for and fed during the winter on private lands, succumb, perhaps, by developing pneumonia.

Another adverse factor that deer encounter at times is the sleet storm. Sleet storms are irregular in their occurrence, but when they are severe they are certain to interfere with the efforts of deer to obtain food. Such storms follow the thawing spells when rain changes to ice with the dropping of the temperature. During the past winter (1930-1931) there were no such storms, but I was told that one occurred in December, 1929, as a result of which all twigs and branches were encased in ice for nearly a week. Deer, accordingly, to get food at all, had to manage as well as they could with these icy twigs.

SUGGESTIONS FOR RELIEF OF DEER IN CONGESTED AREAS

Some suggestions are doubtless expected from a field man who has covered some of the ground in starving time and has viewed some of the situations, at least, that develop during critical periods of the winter. It is very difficult, however, to make suggestions that will be practicable in all respects and for all localities. Any attempt to feed or otherwise care for deer on a large scale in winter must necessarily involve considerable expenditure of labor and funds.

In areas easily accessible to hunters perhaps little need be done in providing food for deer, for the animals ordinarily do not congregate in such numbers in these places as to exhaust or seriously

reduce the natural food supply. In the remoter sections, on the other hand, the difficulty of providing food must be taken into consideration. Many of these areas are inaccessible except on foot, so the transportation of deer feed in quantity would be no easy matter.

I heard a number of times the airplane suggested as a possible means of transporting feed into the interior, but the idea was always scoffed at as impracticable. Pennsylvania has, however, tried the airplane method, and with some success. It is very probable that if the plane flew low enough bundles of alfalfa could be dropped in certain places that might become regularly visited feeding stations.

It might be a workable plan, also, in regions where logging roads lead back for some distance into the forest, to take hay to suitable places in the fall and store it under improvised fenced-off shelters until late in the winter, when game protectors equipped with snowshoes might distribute it. It seems that where deer perish in large numbers it might even pay to maintain a winter camp for a protector or two, who would enter the region about the middle of January and spend the next eight weeks or more looking after the welfare of the animals in their territory. If a money value is to be placed upon deer the loss sustained through the death of hundreds of them would be considerably greater, probably, than the cost of the special protection given them in various sections each winter for a period of about two months. There seems to be ample proof that deer will eat alfalfa, with a minimum of waste, and that they will thrive on it. The chief problem is that of getting the food to them.

The whole matter is largely one for sportsmen and hunting organizations to take up as they are the persons chiefly interested, and they are in a position to bring pressure to bear on the proper agencies. Recommendations coming from such organizations would, probably, have greater weight and be more effective with the authorities than any which might be offered by the field man who goes into the region for a short time simply to make a study of conditions as he finds them.

SOME POPULAR NOTIONS REGARDING DEER

That they will not eat marsh hay. I was told of attempts in southern Hamilton County to stack marsh hay to be fed to deer in winter, and that the experiment failed. Upon inquiry I found that the hay had been stacked where cut, i. e., out in the open marsh.

Of course by the time deer are in need of the food stored in such situations the snow surrounding it is so deep that they cannot get to it. Mr. Kenwell, of Inlet, has made hay feeding experiments



Fig. 214. Pulp logs on the ice at Lake Sanford, Tahawus, N. Y., ready for spring floating. This is in good deer country and it is believed by many residents that pulp-lumbering operations rob the deer of good yarding swamps. March 14, 1931.



Fig. 215. Hudson River near its source, the outlet of Lake Sanford, Tahawus, N. Y. March 12, 1931.



Fig. 216. Carcass of fawn caught between V-shaped forks of a small cedar. The remains were partly eaten by foxes. March 13, 1931.



Fig. 217. Forelegs of fawn shown above, indicating how it had worked itself into a position from which it could not be extricated. March 13, 1931.

with better results. In stacking the hay, however, he transported it to the neighborhood of the deer yard, stacked it fairly green and salted it somewhat at the same time. He then surrounded it with a fence until late in the winter when deer were given access to it. Mr. Kenwell writes (personal correspondence) of his experiments: "If you were to examine one of these stacks say along in February, it would remind you of a beech stub where the woodpeckers had been drilling. The side of the stack would show so many holes where the deer had been feeding." The objection has been offered by some persons that by salting the hay, a salt-lick was apt to be established; but, of course, surrounding the stack with a fence would avoid this objection, in as much as it would be inaccessible to deer during the hunting season.

That hundreds of does are killed in the hunting season. One of the stock arguments presented in favor of an open season on does as well as on bucks is that hundreds of does are killed during the season, anyway, and if the hunter were permitted to take out one animal of either sex he would be able to secure a deer and be on his way. Whereas, if he can take out only a buck he will remain until he has in his excitement or haste killed several does before he gets a buck. In this way, it is argued, the number of does is greatly reduced. This idea, like so many other popular notions on various subjects, appears on the face of it so reasonable that it is easily passed from mouth to mouth and accepted, without much critical thought given to it. On the other hand, those who roam the woods with a critical eye, while they do find an occasional doe with gun wounds, yet do not find "hundreds". Of course, the legalized killing of does, generally speaking, would be as detrimental to the deer herds as anything that might occur during the hunting season; for with the one shot, two or three deer would in fact be wiped out. Most does, it is generally held, have one fawn the first time, and thereafter, twins. These fawns doubtless depend more or less upon the mother to get them successfully through their first winter; deprived of her guidance they are at least handicapped and more likely to perish in adverse conditions. Add to these the unborn young of pregnant does and we may reasonably charge that a total of five deer would sometimes be destroyed by the killing of one doe in the hunting season. It is very easy, when we greatly desire something, to make out a case in its favor and, if several of us agree on our desires, we will agree also on the excuses to foster them. There can, however, be no valid reason, generally speaking, for an open

season on does. In case of their excessive numbers, special measures can always be undertaken.

That deer are becoming smaller through inbreeding. Since time immemorial there have doubtless been deer in considerable numbers in certain restricted regions of the Adirondacks or other deer-inhabited areas. Their natural tendency to remain in their home range would, of course, tend to a mating at times with near relatives. This has no doubt been done for centuries, but the person who argues that this produces a deterioration in the stock does not seem to realize that good qualities will carry through just as well as bad ones. And it has always been nature's law that the fit will survive: cripples and inferior animals are gotten out of the way in a natural manner so that they do not live to reproduce and continue any weaknesses which occasionally appear.

That periodical dogging of deer should be allowed. The inbreeding argument is used in favor of restoring this practice. Could the bucks be driven by dogs, it is contended, they would run to other areas and remain there, introducing new stock and thereby making for an increase in size and quality of the animals. The question arises, however, will the dog always exercise choice in running a buck or will it run the first animal it comes across! In the latter case, does and weaklings will be run also. Furthermore, the homing instinct in wild animals is usually very strong, and it would take persistent dogging to drive the animals far. They would merely circle—as is the habit of rabbits, foxes and other animals—and return to their home territory as soon as they felt they had eluded or outdistanced their pursuers. The agitation in favor of dogging seems to be merely another instance where the desire for a certain sort of hunting attempts to make a good case for itself.

The answer to the question as to why the bucks are so small seems to be found in the two general types of areas (more settled community and the "back country") in which deer now occur. In the thickly settled areas, where deer territory is easily accessible and where there is an over-supply of hunters, what chance does a buck have to attain age and size when he is killed and carried out as soon as his antlers are beyond the spike stage? In the back country, which because of its comparative inaccessibility is reasonably free of hunters, the deer are crowded into close quarters because of limitations of food, especially, and many of the older bucks, often experiencing severe winters following close upon the stress of the breeding season, succumb to starvation and the elements. In the



Fig. 218. Rock River between Blue Mountain Lake and Indian Lake village. Snow comes to the water's edge on the south bank, while the north bank with southern exposure is comparatively free of snow. April 9, 1931.



Fig. 219. Portion of Sumner Stream after a few days of thawing. In the heart of the Hamilton County deer country. March 27, 1931.



Fig. 220. G. A. Kenwell with doe which he ran down on snowshoes. This is possible in late winter when snow is deep and the animals are weakened by lack of food and the rigors of winter. March 27, 1931.



Fig. 221. The melting snows of March expose many fawn carcasses that have been covered since early winter. Many are partially eaten by foxes. March 24, 1931.



Fig. 222. Emaciated carcass of a large buck in the Moose River area; typical of the many carcasses found. March 24, 1931.



Fig. 223. South Branch of Moose River, north of West Canada Lakes. It was along this stream that G. A. Kenwell and the author found over 70 carcasses in three days. March 24, 1931.



Fig. 224. South slope of a knoll along South Branch of Moose River, Hamilton County. These southern exposures lose their snow with the first thawing days, and weakening deer seek them after the chilly spring nights. March 24, 1931.



Fig. 225. Dead fawn found along the bank shown in figure 224. Many dead deer were found in such situations. March 24, 1931.

Moose River country Mr. Kenwell and I found a number of emaciated carcasses which in good health would doubtless have weighed two hundred pounds or more. It is commonly said by old residents in the north woods that, "Deer aren't what they were for size when I was a young fellow. Why, when I used to hunt as a young fellow, we'd get deer . . ." and then follows the usual tale of the buck that regularly dressed out three hundred pounds or better. Of course some people have lived long enough to forget a great deal, and a buck of such size would at any time be considered large.

That deer are responsible for the even trimming of cedars along certain small lakes and ponds. This is another idea which appears reasonable from a number of angles, and is passed from man to man or handed down from one generation to another, accepted and believed without any critical examination as to whether true or false. Deer are seen feeding on cedars when the lakes are frozen over, and the line of demarcation between the living and the dead cedar branches is in many places at just about the height the average deer could well reach by rearing up on its hind legs. A number of facts enter into the question, however, which throw a good deal of doubt on the popular notion. Upon most of the lakes the snow drifts pile up along one side where it is swept by the wind, while on the sheltered side it lies on the ice in its undisturbed condition. The line on the cedars, however, is at the same height all around the pond, whereas if deer had been the cause of it, it should, at least in many instances, be much higher on one side of the lake where the snow had piled up than on the other. Then, also, the line in places passes directly through a tangle of fallen trees and brush which are clearly inaccessible to deer. Likewise, if deer are so voracious when it comes to the devouring of cedars why do the lower twigs live to become branches at all? Why are they not eaten right up against the trunk and so kept trimmed back altogether?

It is true, also, that about certain ponds and lakes part of the cedar belt shows this regular line, while in other parts the foliage extends down clear to the water (Fig. 213). And this condition I found in country thickly populated with deer. During the past winter, in the Raquette River country, between Raquette Lake and Long Lake, deer had fed on cedars the lower branches of which had been eaten or trimmed, leaving the larger twigs which with the coming of spring showed evidence of putting forth new foliage. Twigs and branches below the line of demarcation are entirely dead

and no new foliage ever appears upon them. The reappearance of new leaves on those branches which the deer feed on is evidence that the browsing of deer does not kill them. Since the line of demarcation is so regular, and the character of the dead branches is all the same and without the usual signs to be seen in connection with browsing, it would seem that the browsing theory does not answer the question satisfactorily. This whole question has been treated rather fully by Johnson ('27a, pp. 213-227), and my own observations are in close agreement with the facts as stated by him.

SUMMARY

The whole question of the ease or difficulty with which deer survive abnormal winters must be answered by the availability of food and shelter, together with the differences noted between the various localities. The winters appear to be less severe in the southern and eastern portions of the Adirondacks than in the central and northern parts. In regions where there is usually less snow and cold, as in the Lake Champlain and Lake George areas, deer should be able to winter in good condition without very much assistance from man.

In the central Adirondacks, on the other hand, there will be times when deer on State land should receive the same protection and care that those on private preserves regularly receive. In areas which are depleted each year by hunting, the remaining animals should be insured an adequate food supply to see them through the winter. As has been suggested this should not be difficult in regions adjacent to the State roads and settled communities.

In the more distant "back country" sections, seldom penetrated to a great extent by men, deer are usually numerous. While many may die from lack of food or because of the severe conditions of early spring, nature will probably have to be left to take care of the adjustment in these sections. There are, however, areas popularly known as "back country" which are accessible to a considerable extent, such as the West Canada Lakes and Moose River districts, where men hunt in some numbers every fall. Wagon roads lead into such places, and where it is possible to bring out the carcasses of deer killed during the hunting season it should be feasible to haul food to the animals where they are likely to suffer from want of it in winter.

The matter of artificial care of deer is largely one of local interest and it appears to me that it is the proper duty of the local hunting or sportsman's clubs to bring about the necessary provision.



Fig. 226. A four-inch fall of snow which came at Raquette Lake, April 27. This heavy, wet snow is inimical to the early born fawns. April 28, 1931.

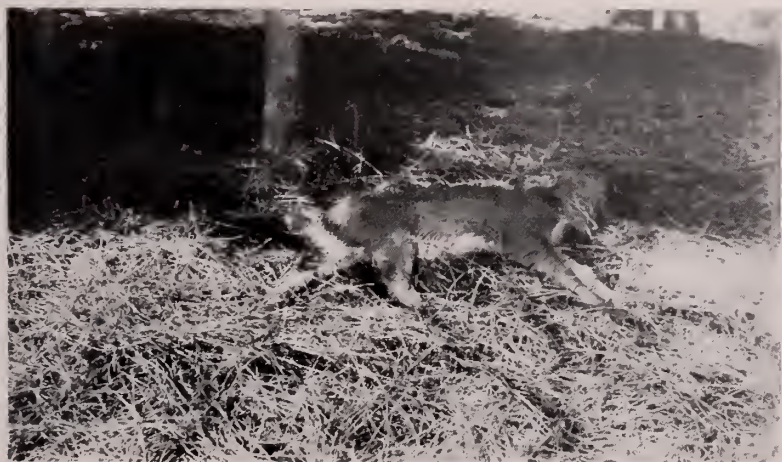


Fig. 227. A dead fawn at one of the hay sheds in Nehasane Park. Even with an abundance of food provided, many fawns cannot withstand the extremes of temperature which come in the spring. March 22, 1930.

REFERENCES

ADAMS, CHARLES C.

1921. Suggestions for the Management of Forest Wild Life in the Allegany State Park, New York. *Roosevelt Wild Life Bull.* Vol. 1, No. 1, pp. 62-74.

ALLEN, GLOVER M.

1929. History of the Virginia Deer in New England. Paper read at Conference, Mass. Fish and Game Assoc., January 11, 1929, pp. 19-38.

CARPENTER, WARWICK S.

1921. The Whitetail Deer in New York, a Study of the Operation of the Buck Law. Conservation Commission, State of New York. Pp. 1-31. Albany.

CLEPPER, HENRY E.

1931. The Deer Problem in the Forests of Pennsylvania. Dept. of Forests and Waters, Commonwealth of Pennsylvania Bull. 50, pp. 1-45.

COFFIN, FRANCIS H.

1928. Game Administration in Pennsylvania. The Board of Game Commissioners, Commonwealth of Pennsylvania Bull. 10, pp. 1-21.

CONKLIN, W. GARD

1930. Pennsylvania's State Game Refuges and Public Hunting Grounds. The Board of Game Commissioners, Commonwealth of Pennsylvania Bull. 14, pp. 1-64.

CONKLIN, W. GARD, and MORTON, JAMES N.

- More Food for Upland Game. The Board of Game Commissioners, Commonwealth of Pennsylvania, Bull. 11, pp. 1-30.

COOK, O. F.

1909. The Superiority of Line Breeding over Narrow Breeding. Bureau of Plant Industry. U. S. Dept. Agric. Bull. 146, pp. 1-45.

EAST, EDWARD M., and JONES, DONALD F.

1919. Inbreeding and Outbreeding. Pp. 1-285. J. B. Lippincott Co.

HEWITT, C. GORDON

1921. The Conservation of the Wild Life of Canada. Pp. 1-344. Charles Scribner's Sons.

JOHNSON, CHARLES EUGENE

1927. The Beaver in the Adirondacks. *Roosevelt Wild Life Bull.*, Vol. 4, No. 4, pp. 501-641.
1927a. On the Supposed Relation of Deer to Cedars Bordering Certain Adirondacks Lakes. *Jour. of Mammalogy*, Vol. 8, No. 3, pp. 213-227.

KEELER, HARRIET L.

1912. Our Northern Shrubs. Pp. 1-521. Charles Scribner's Sons.

KENWELL, GERALD A.

1931. Facts Sportsmen Should Know. *The Adirondack Arrow*, Vol. 5, No. 34, pp. 2-5. Old Forge, N. Y.

LANTZ, DAVID E.

- 1908. Deer farming in the United States. U. S. Dept. Agric. Farmers Bull. 330, pp. 1-20.
- 1910. Raising Deer and other Large Game Animals in the United States. U. S. Dept. Agric. Biol. Survey Bull. 36, pp. 1-62.

NEWSOM, WILLIAM M.

- 1926. Whitetailed Deer. Pp. 1-288. Charles Scribner's Sons.

NEW YORK STATE

- 1901. Seventh Report of the Forest, Fish and Game Commission, pp. 34-38. Albany.
- 1902. Eighth Report of the Forest, Fish and Game Commission, pp. 75-79. Albany.
- 1903. Ninth Report of the Forest, Fish and Game Commission, pp. 139-145. Albany.
- 1904-1906. Annual Reports of the Forest, Fish and Game Commissioner for 1904-1906. Pp. 233-234, 247-251, 273-282. Albany.

PENNSYLVANIA, BOARD OF GAME COMMISSIONERS

- 1930. The Pennsylvania Deer Problem. Bull. 12, pp. 5-66. Harrisburg,

SETON, ERNEST THOMPSON

- 1909. Life Histories of Northern Animals. Vol. 1, pp. 68-113. Charles Scribner's Sons.

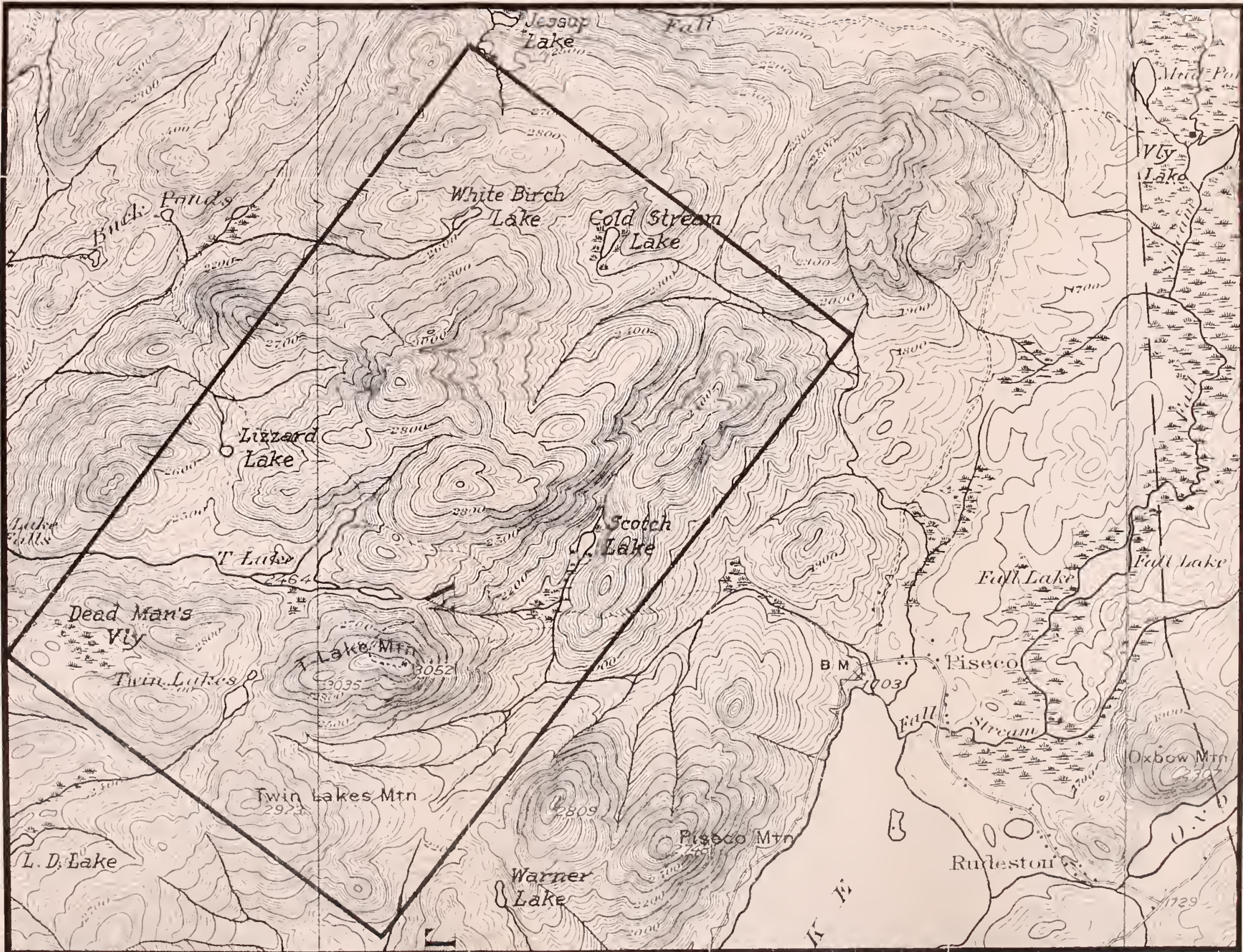
STONE, WITMER, and CRAM, WILLIAM EVERETT.

- 1910. American Animals. Pp. 1-318. Doubleday Doran and Co.

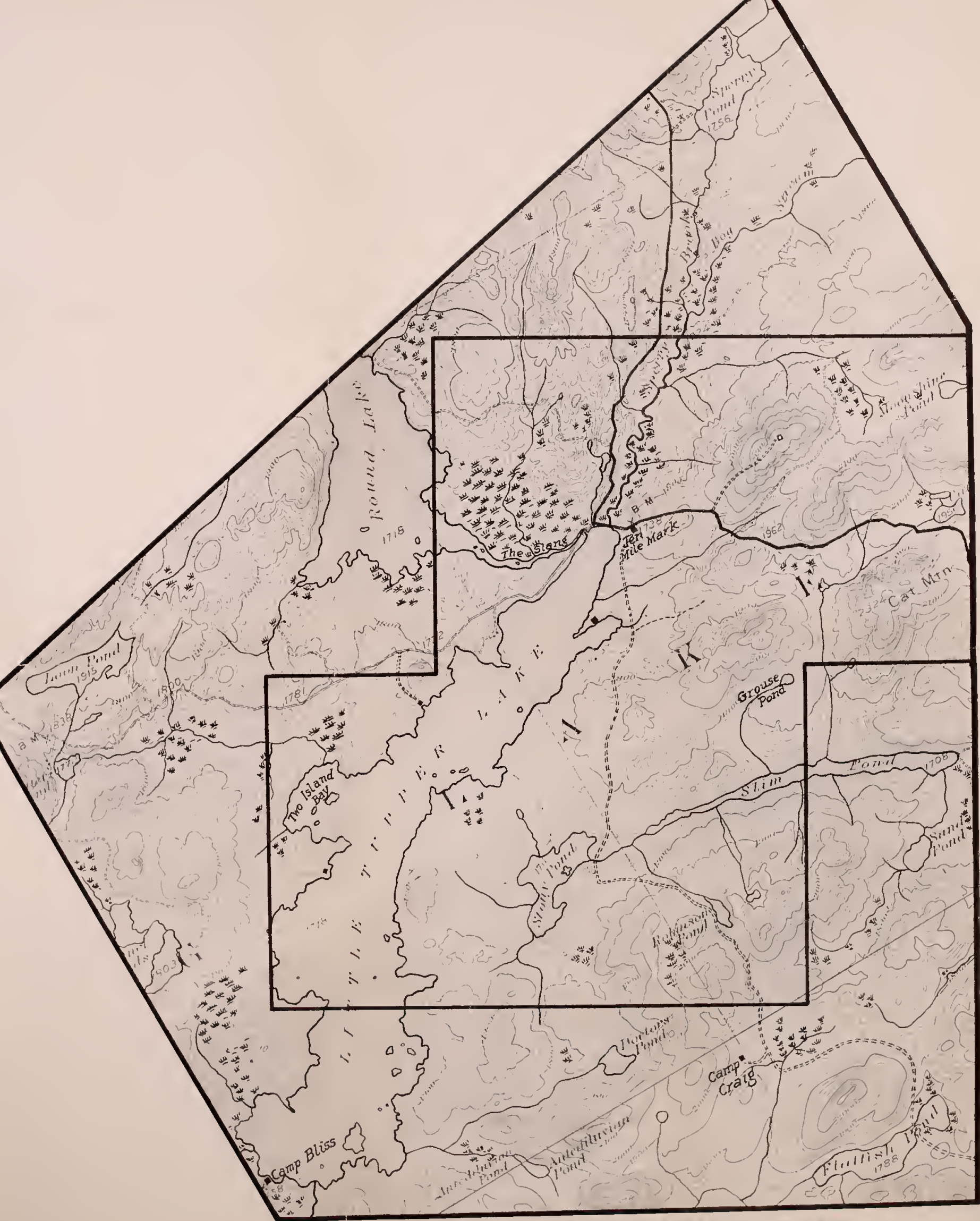
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Map 3. Areas studies in the Big Moose and Brandreth regions. Adapted from the U. S. topographical map.



Map 5. The Piseco Lake region. The rectangular area at the left center represents approximately 10 square miles. Modified from the U. S. topographic map and enlarged 2x.



Map of the Upper Lake region. The area shown with a black line in the center of the map represents about 20 square miles where most of the intensive studies for this region were made. Modified from the U. S. Topographic map and dated 25.



Map 8. Long Lake and Whitney Park areas. Feeding stations are indicated by the symbol "F" and the numbers preceding the symbols refer to the approximate number of deer visiting these stations. Approximate boundaries of deer yards visited are indicated with broken lines. Area number 1 represents a summer range of deer in the Grapewine Lake burn, area number 2 a summer range in the Cold River burn. Adapted from the U. S. topographical map.



Map of Moose River region showing deer yards visited and the number of dead deer found. Sixty-six dead deer were found during the last week of March, 1931, in area number 1. Forty-eight dead deer were reported by a forest ranger from area number 2. Adapted from the U. S. topographical map.

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The State of New York is the trustee of this wild life Memorial to Theodore Roosevelt. The New York State College of Forestry at Syracuse is a State institution supported solely by State funds, and the Roosevelt Wild Life Forest Experiment Station is a part of this institution. The Trustees are State officials. A legislative mandate instructed them as follows:

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By these laws the Empire State has made provision to conduct forest wild life research upon a comprehensive basis, and on a plan as broad as that approved by Theodore Roosevelt himself.

ROOSEVELT WILD LIFE BULLETIN, VOL. 5, No. 1. March, 1928.

1. A Preliminary Wild Life and Forest Survey of Southwestern Cattaraugus Co., N. Y.....Victor H. Cahalane
2. A Preliminary Report of the Trout Streams of Southwestern Cattaraugus Co., N. Y.....Wilford A. Dence
(Out of print.)

ROOSEVELT WILD LIFE BULLETIN, VOL. 5, No. 2. February, 1929.

1. The Fishes of the Cranberry Lake Region.....
W. C. Kendall and W. A. Dence
2. The Story of King's Pond.....F. A. Lucas
3. Its Fish Cultural Significance.....W. C. Kendall

ROOSEVELT WILD LIFE BULLETIN, VOL. 5, No. 3. September, 1929.

1. The Summer Birds of the Northern Adirondack Mountains.....
Aretas A. Saunders
2. The Summer Birds of the Adirondacks in Franklin County, N. Y.....
Theodore Roosevelt, Jr., and H. D. Minot
(Reprinted. Original date of publication, 1877.)

ROOSEVELT WILD LIFE BULLETIN, VOL. 5, No. 4. August, 1930.

1. The Biology of the Voles of New York.....Robert T. Hatt
2. The Relation of Mammals to the Harvard Forest.....Robert T. Hatt

ROOSEVELT WILD LIFE BULLETIN, VOL. 6, No. 1, March, 1931.

1. A Biological Reconnaissance of the Peterboro Swamp and the Labrador Pond AreasChas. J. Spiker

ANNALS

ROOSEVELT WILD LIFE ANNALS, VOL. 2, No. 1. January, 1929.

1. The Red Squirrel: Its Life History and Habits, with Special Reference to the Adirondacks of New York and the Harvard Forest.....
R. T. Hatt

ROOSEVELT WILD LIFE ANNALS, VOL. 2, No. 2. October, 1929.

1. The Ecology of Trout Streams in Yellowstone Park.....
Richard A. Muttkowski
2. The Food of Trout Stream Insects in Yellowstone Park.....
Richard A. Muttkowski and Gilbert M. Smith

ROOSEVELT WILD LIFE ANNALS, VOL. 2, Nos. 3 & 4. (Double Number.) January, 1932.

1. Ornithology of the Oneida Lake Region; With Reference to the Late Spring and Summer Seasons.....Dayton Stoner

ROOSEVELT WILD LIFE ANNALS, VOL. 3, No. 1. January, 1932.

1. Parasites of Oneida Lake Fishes. Part I. Descriptions of New Genera and New Species.....H. J. Van Cleave and J. F. Mueller

ROOSEVELT WILD LIFE ANNALS, VOL. 3, No. 2. October, 1932.

1. Parasites of Oneida Lake Fishes. Part II. Descriptions of new species and some general taxonomic considerations, especially concerning the trematode family Heterophyidae.....
Justus F. Mueller and Harley J. Van Cleave
2. Trichodina renicola (Mueller, 1931), a ciliate parasite of the Urinary bladder of *Esox niger*.....Justus F. Mueller